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WHEAT-MANURING EXPERIMENTS IN CANTERBURY.

SUMMARY OF SIX SEASONS' RESEARCH AND RECOMMENDATIONS TO FARMERS.

Fields Division.

Introduction.

EXPERIMENTS on the manuring of wheat in Canterbury have been in progress for the past six years. Although much still remains to be done before all the manurial problems connected with the wheat crop have been solved, enough has been accomplished to warrant the publication of a general summary of the whole of the experiments up to date.

The results obtained from year to year have already had a great effect on manurial practice in the wheat-growing areas, and the great value of sustained work in this direction is well exemplified by the Department of Agriculture being now in a position to give definite and reliable advice, based not on surmise or opinion but on accurate experimental experience carried out under practical farming conditions.

The successful prosecution of this work is largely due to the untiring efforts of Mr. A. W. Hudson, Crop Experimentalist, who is wholly responsible for the designing of the experimental work and for the very excellent technique now generally adopted by the Department. This technique, from the standpoint of accuracy, leaves little to be desired, and at the same time fits in admirably with the requirements of the farmer.

In this connection one cannot refrain from expressing appreciation of the generous help afforded the Fields Division by co-operating farmers, who have placed land and facilities at our disposal, and have created a bond of sympathetic interest which has made the work a pleasure to all the staff.

The very large amount of field work involved has been admirably carried out by the field staff, of whom Messrs. A. Y. Montgomery, R. A. Calder, E. M. Bates, A. G. Elliott, and W. Stafford must be especially mentioned. They have all spent much time outside ordinary

hours in assuring the success of the work, and have at least the satisfaction of knowing that they are contributing in no small degree to the general adoption of methods that will tend to the immediate increase of our wheat yields, and that on a very profitable basis.

—A. H. Cockayne, Director of the Fields Division.

Initiation and Development of the Work.

The wheat-manuring experiments were commenced in 1923 by a group at Christchurch known as the Soils Improvement Committee, set up at the instigation of Mr. G. H. Holford. The committee consisted of representatives of the Department of Agriculture, Canterbury Agricultural College, and several firms and others interested in the development of scientific agriculture. In the first season the firms represented contributed manures for the trials. Subsequently the work here described was taken over entirely by the Department of Agriculture, and with modification of equipment and technique has developed in the manner to be indicated.

From two experiments in the 1923–24 season the number increased to twenty-six actual harvested trials in 1928–29. Eight others were laid down in the latter season, but on account of weather and other conditions could not be harvested. In addition, seven comprehensive trials to test the effect of various disease treatments on yield were carried out in 1928–29. For four seasons the work had to be confined to a restricted area of wheatgrowing land in the vicinity of Christchurch. Better facilities for the sowing and threshing of crops has enabled the work to be extended to most of the principal wheatgrowing districts in Canterbury and North Otago, and an extension to Marlborough in the 1929–30 season is anticipated. Figs. 1 and 4 indicate the nature of the equipment now in use.

The methods of conducting trials have been described in the *Journal* from time to time, and a list of references is given at the end of this article which will enable interested readers to get fairly full details not only of methods but also of the yields of individual experiments.

Problems under Investigation and Necessity for their Modification as Work progressed.

The original programme of work provided for the determination of the relative merits of superphosphate and basic super, and for the comparison of each of these with a mixture of itself and a small amount of nitrogen in the form of dried blood. It soon became apparent that the difference between super and basic super was so slight as to necessitate a large amount of work in its determination. This work has been continued with results as will be indicated.

In the case of the mixture containing blood as a form of nitrogen, the inconclusive nature of results clearly pointed to the necessity for increasing the amount of blood. This was increased to 1 cwt. per acre and added to the basal dressing of 1 cwt. of phosphate (super or basic super). Also, in two experiments in the 1925–26 season nitrate of soda and sulphate of ammonia were used, as representing more efficient forms of nitrogen. The use of the 1 cwt. quantity of blood

was continued for two seasons, and results were still inconclusive in most cases, although the indications were that nitrogen used at the greater quantity was beneficial. This was definitely so where the soluble forms of nitrogen—nitrate of soda and sulphate of ammonia—were being used. In order to arrive at a definite conclusion as to whether or not nitrogen, *as an adjunct to phosphate*, was beneficial, it was evident that all consideration of the form of nitrogen must be dropped for the time being, and an effort made to decide the major problem, "Does the use of the most efficient form of nitrogen, used in a reasonable quantity, as an adjunct to phosphate, increase yield over that given by straight-out phosphate?" Nitrate of soda was selected as being in all probability the most efficient form of nitrogen under Canterbury conditions.

The results shown later indicate the advantage of this modification. The introduction of the trial of potash in conjunction with phosphate and phosphate plus nitrogen was made in the 1925–26 season. For two seasons ½ cwt. of sulphate of potash was used. Depression in yield as a result of its use occurred in one or two cases, and an increase was obtained in two cases, in the seasons 1925–26 and 1926–27. Evidently, then, the potash question was in much the same position as that of nitrogen, and in the seasons 1927–28 and 1928–29 the quantity used was increased to 1 cwt. per acre.

In these last two seasons the main extension of the work to the principal wheatgrowing districts throughout Canterbury occurred, and standard types of experiments were adopted. Two other forms of phosphate — Ephos and Nauru — were also introduced, because experienced and observant farmers claimed certain advantages from these manures over the more readily available ones. The usual contention was that the slower-acting phosphates did not cause such a rank growth in the early part of the season and "carried the crop on" longer at ripening-time. These contentions are quite correct, but evidence from experiments has shown that they *do not* indicate increased yield or quality of sample—quite the contrary, in fact. These points will be enlarged on later.

Treatments used in 1927–28 and 1928–29 Experiments.

The manurial programme in the past two seasons was as follows:—

Type A Experiments.

(1) No manure.
(2) Superphosphate (44–46 per cent. tricalcic phosphate) .. 1 cwt.
(3) Basic super (41–43 per cent. tricalcic phosphate) .. .. 1 cwt.
(4) Ephos phosphate (guaranteed 54 per cent. tricalcic phosphate) 1 cwt.
(5) Nauru phosphate (approximately 80 per cent. tricalcic phosphate) .. .. 1 cwt.

Type B Experiments.

(1) Superphosphate .. .. 1 cwt.
(2) Super 1 cwt., plus muriate of potash (51 per cent. K_2O) 1 cwt. 2 cwt.
(3) Super 1 cwt., plus nitrate of soda (15·5 per cent. nitrogen) 1 cwt. .. .. 2 cwt.
(4) Super 1 cwt., plus muriate of potash 1 cwt. and nitrate of soda 1 cwt. .. .. 3 cwt.

One each of these experiments was laid down on the same paddock on each farm under trial.

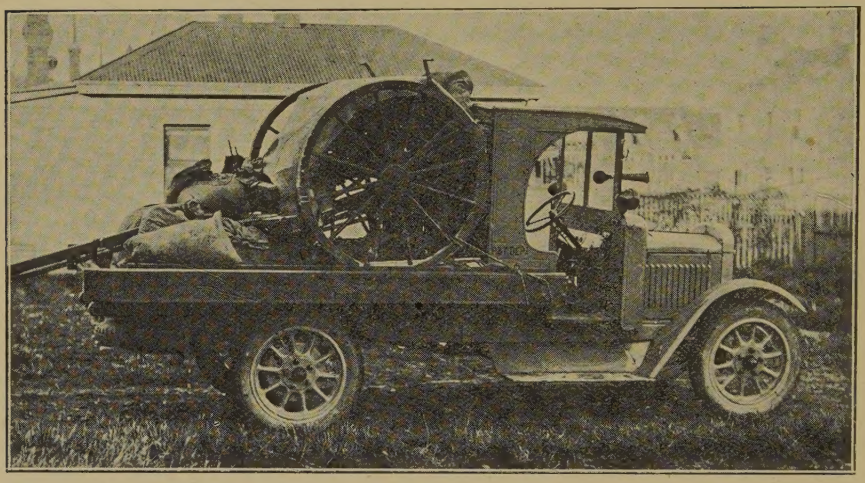


FIG. 1. SEVEN-COULTER DRILL USED FOR SOWING EXPERIMENTS, TRANSPORTED ON A MOTOR-LORRY.

The advantages of having a special machine of this size are as follows: (1) The drill is easy to convey from farm to farm; (2) a high degree of accuracy in sowing manures can be attained; (3) the minimum of time is occupied in getting necessary adjustments for quantities of seed and manure (preliminary adjustments for manures are made before the machine leaves the Department's depot); (4) plots can be repeated a large number of times without the area occupied by an experiment being unduly large.

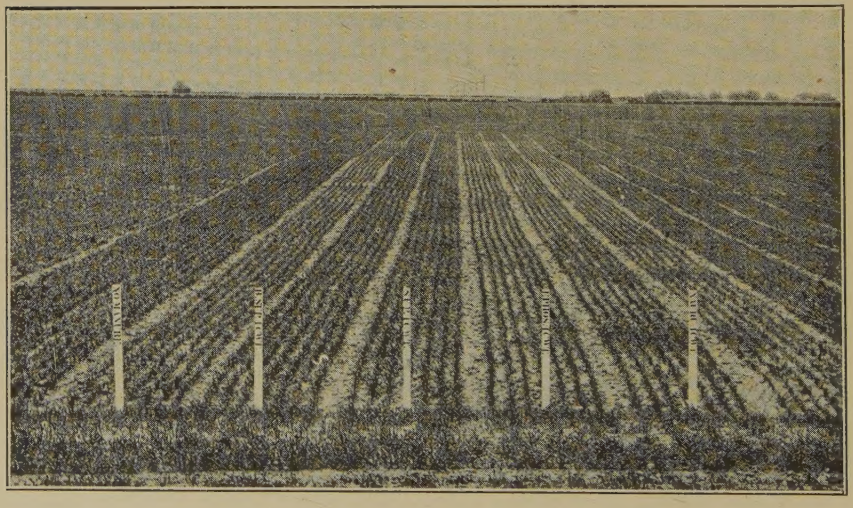


FIG. 2. PORTION OF A TYPICAL EXPERIMENT SOWN WITH THE DRILL SHOWN IN FIG. 1.

The pegs shown in the photo indicate the following treatments (left to right): (1) No manure; (2) basic super, 1 cwt.; (3) super, 1 cwt.; (4) Ephos, 1 cwt.; (5) Nauru, 1 cwt. Ten replications of this series constitute the experiment. A 14-in. space is left between outside rows of adjoining plots. Each experiment is so designed as to be sown in one day. Thus conditions at time of sowing are as uniform as it is possible to get them.

Increased Yields as a Result of using Superphosphate at 1 cwt. per Acre.

During the period of six years under review, thirty-three trials in which super has been compared with no-manure have been conducted. Of these, five have failed to give any significant increase, while the remaining twenty-eight have shown increases of from 1·2 to 13·8 bushels per acre. The average increase over the thirty-three trials has been 5·1 bushels per acre.

Valuing wheat at 5s. per bushel and super at 5s. per cwt. (not allowing for cost of cartage or application), it is evident that an increase of 1 bushel meets the cost of manure. The increase of just over 5 bushels shows a good profit of about £1 per acre, or about 400 per cent. on the outlay.

Superphosphate Response in Relation to Natural Yields of Fields under Experiment.

Further analysis of the thirty-three trials in which super is compared with no manure has been made in the above respect. The experiments have been divided into (*a*) those having yields on the unmanured plots (natural yields) of *less* than 40 bushels per acre, and (*b*) those having yields on the unmanured plots of *more* than 40 bushels per acre.

The average increase for super has been calculated in both cases, and the results are as follows:—

(*a*) Average super increase on fields with natural yields of *less* than 40 bushels per acre = 6 bushels per acre, with a range of from 1·2 to 13·8 bushels.

(*b*) Average super increase on fields with natural yields of *more* than 40 bushels per acre = 4·4 bushels, with a range of from 0 to 10·4 bushels.

The data are somewhat limited for such examination, but probably indicate the position fairly accurately. Further, they indicate that high-yielding land is quite capable of responding to a highly paying extent to the use of superphosphate. On the experiment having the highest natural yield of 68 bushels per acre super gave an increase of 7 bushels.

Superphosphate compared with Basic Super.

Twenty-nine of the above-mentioned trials had plots receiving basic super at the same rate per acre as the super. In no single case has basic super proved superior to super in increasing yields. In about a quarter of the trials super has established a significant superiority over basic super. In the remainder super was generally a little better than basic super, but significance could not be attached to the individual results. Statistical examination of the twenty-nine trials reveals the following:—

	Bushels per Acre.
Increase of super over no manure	5·5
Increase of basic super over no manure	4·3
Difference in favour of super	1·2

The difference is significant. Therefore it can be concluded that 1 cwt. of super is generally a better phosphatic manure for wheat than basic super.

Further Analysis of Comparison between Super and Basic Super.

As in the case of the comparison between super and no-manure, the twenty-nine comparisons between super and basic super have been divided into two parts: (*a*) Those on fields with natural yields below 40 bushels per acre, and (*b*) those on fields with natural yields above 40 bushels, with the following results:—

(*a*) Average increase of super over basic super on thirteen experiments having natural yields below 40 bushels = 1·9 bushels per acre.

(*b*) Average increase of super over basic super on sixteen experiments having natural yield above 40 bushels = 0·7 bushel per acre.

Thus the contention that slower-acting phosphates are more readily available on good than on poor land would appear to apply in the case of wheat land, but at the same time these results indicate that the use of basic super in preference to super is not justified, even on the "stronger" wheat soils.

Super compared with Ephos and Nauru Phosphates.

In all, seventeen trials in which all three of these forms of phosphate were used have been conducted in the past two seasons. The yields from 1 cwt. of super have been superior to those from 1 cwt. of Ephos or 1 cwt. of Nauru in fifteen of the experiments. In two cases there was no response from any form of phosphate.

Taking the average increases over no-manure given by these three phosphates in the seventeen trials, a very appreciable and significant superiority of super is evident, as follows:—

	Bushels per Acre.
Increase of super over no manure	5·6
Increase of Ephos over no manure	2·0
Increase of Nauru over no manure	1·5

The superphosphate yields thus show an average increase of 3·6 and 4·1 bushels per acre over those of Ephos and Nauru respectively.

Effect of adding Nitrogen in Form of Dried Blood to Superphosphate or Basic Super.

These remarks apply only to those trials in which blood was used at the rate of 1 cwt. per acre. The trials numbered seven. The average increase of phosphate plus blood over phosphate alone was 3·2 bushels per acre, the increases ranging from 0 to 5·6 bushels. In all cases the blood and super were mixed and sown at the time of seeding.

Results of using Soluble Nitrogen in Conjunction with Superphosphate.

In all, twenty-five trials have now been completed in which soluble nitrogenous fertilizers have been tested. In twenty-two of these trials nitrate of soda was used at 1 cwt. per acre (except in three cases where only ¾ cwt. was applied). In the other three trials sulphate of ammonia at ¾ cwt. was used. Both forms have been applied in spring, generally on autumn- or winter-sown wheat which had received 1 cwt. of super per acre at seeding.

Only in four experiments has the nitrogen failed to increase the yield. On the remaining twenty-one trials the increases ranged from

1 to 11·1 bushels per acre. *The average increase from all trials resulting from the use of soluble nitrogen has been 5·1 bushels per acre.*

On one farm nitrate of soda has been used for four successive seasons. Every year the increase resulting from its use has been between 5 and 6 bushels per acre.

Cost of Nitrogen.

The market prices for nitrate of soda and sulphate of ammonia in recent years have ranged from 18s. to 21s. per cwt. in the case of the former, and from 15s. to 25s. in the case of the latter. At these prices the use of nitrogen would not appear to be a tempting practice. It is confidently expected that certain soluble nitrogenous fertilizers will be procurable next season at about 12s. 6d. to 13s. per unit of nitrogen. This is equivalent to 12s. 6d. to 13s. per hundredweight for sulphate of ammonia, which contains 20 per cent. of nitrogen. At this price a little over 2½ bushels of wheat at 5s. per bushel will pay for the manure, and if future results confirm those of the past it is evident that on the average the use of 1 cwt. of one of the ordinary soluble nitrogenous fertilizers will result in a further profit over that from super of about 12s. per acre.

Earlier in this article it was shown that super will give a clear profit of about £1 per acre on an average, and the indications are that by using nitrogen as stated this profit can be increased to about £1 12s. per acre.

Results of adding Potash to Superphosphate.

In nineteen trials 1 cwt. of muriate of potash has been added to 1 cwt. of super and the mixture compared with 1 cwt. of super alone. The manures have been applied with the seed, and in the majority of cases the use of the potash has delayed and in some cases depressed germination. The depressing effect of potash on germination and the growth of seedling plants when it is sown with the seed has also been reported on by workers in other parts of the world.

In one case in the experiments under review an actual depression in yield of over 4 bushels to the acre occurred with the use of potash. In five experiments the potash actually increased yields, but to a profitable extent in *one* case only, when the increase amounted to 4·6 bushels per acre. No other increase has exceeded 2·3 bushels. For the above-mentioned nineteen trials the average increase of super plus potash over super alone has worked out at 0·3 bushel per acre.

Effect of using Potash in conjunction with Super and Nitrogen.

During the seasons 1925–26 and 1926–27 sulphate of potash at ½ cwt. per acre was used as an addition to 1 cwt. of super and 1 cwt. of dried blood in seven trials. An increase of 2·7 bushels could be attributed to the potash in one case. Apart from this no significant increase occurred. In the seasons 1927–28 and 1928–29 the use of 1 cwt. of muriate of potash was adopted, and out of twenty trials only one gave a significant increase, amounting to 2·5 bushels, due to potash.

In six of the trials the use of potash in conjunction with super and nitrate of soda has caused the yield to be reduced to below that given by super and nitrate of soda alone. The depression in every

case was significant, and ranged from 1·4 to 6·5 bushels per acre. It was in some of those experiments in which potash added to super caused increases (see preceding section) that a number of the above-mentioned cases of depression occurred. Further, in none of the cases in which potash was added to super and nitrate of soda has a beneficial effect been recorded.

The average yield of the super plus nitrogen plus potash treatment in the twenty trials is 1·3 bushels *lower* than the average of the super and nitrogen treatments. An interesting chemical research problem presents itself in regard to what factor or factors are responsible for the depression in yield which sometimes accompanies the use of the fertilizers as mentioned above.

No beneficial effects from potash in assisting the crop to resist disease have been observed in the experiments.

Effect of Prior Crop on Phosphate Response in Wheat Crop.

The argument that the use of phosphate is not economical on the wheat crop sown on a paddock which has been in grass just previously is often advanced. The following analysis of the increased yields resulting from super on thirty-one experiments is of interest.

Table showing Relationship between Wheat Response to Phosphate and Prior Crop.

Crop preceding Wheat Experiment.	Number of Times Crop in Column 1 preceded.	Average Increase due to Super. (Bushels per Acre.)	Range of Increase. (Bushels per Acre.)
Grass	7	5·4	1·8 to 7·2
Wheat, oats, barley ..	9	4·0	0 to 10·3
Potatoes	9	5·6	0 to 10·8
Peas or vetches	5	3·1	0 to 8·1
Rape	2	3·0	2·7 to 3·3

Alleged Bad Effect of Superphosphate on Maturity of the Crop.

The statement that superphosphate causes an excessive spring growth and fails to "carry the crop on" or "blights it off" is often made by farmers. Super certainly does, as a rule, hasten tillering and growth in the spring. When this occurs the crop will often mature from two to five days sooner than a portion of the same crop which has not been manured, or which may have been manured with a slow-acting phosphate such as Ephos or Nauru. The early ripening is then interpreted as failure to "carry the crop on," or as "blighting off."

So far as the experience gained from the experiments under review is concerned, the features of rapid spring growth and early ripening *are almost infallible indications of increased yield, and the more marked these features are, the greater the increase.* Their non-occurrence does not necessarily mean no increase. In fact, on heavy-yielding land it is sometimes extremely difficult to detect differences. A 5-bushel increase in the case of a 50- to 60-bushel crop is practically impossible to detect by observation.

The effect of super on growth is never apparent until from three to eight weeks after the plants appear above ground. The cycle of

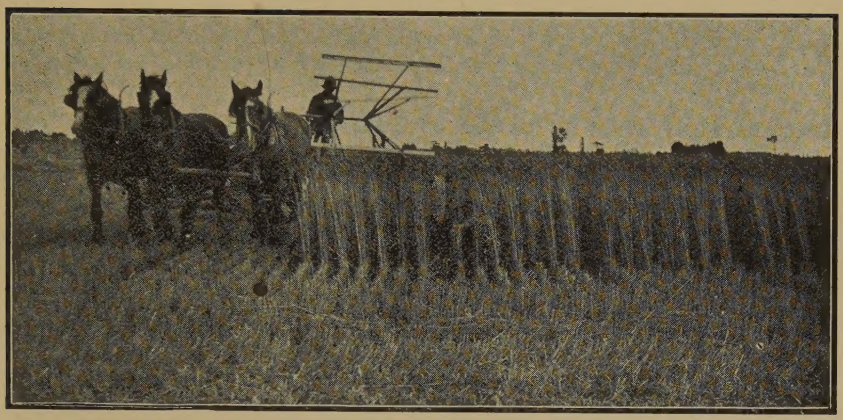


FIG. 3. CUTTING PLOTS OF A MANURING EXPERIMENT WITH A HORSE-DRAWN REAPER-AND-BINDER.

A straight cut is first made across the ends of all plots. In cutting each plot the outside divider of the binder can be easily guided down the 14-in. space. By driving the machine about 18 ft. past the end of the plot the last of the material cut is delivered on to the binding-table. The trip is then pressed and the material discharged, leaving the machine clean before the next plot is commenced.

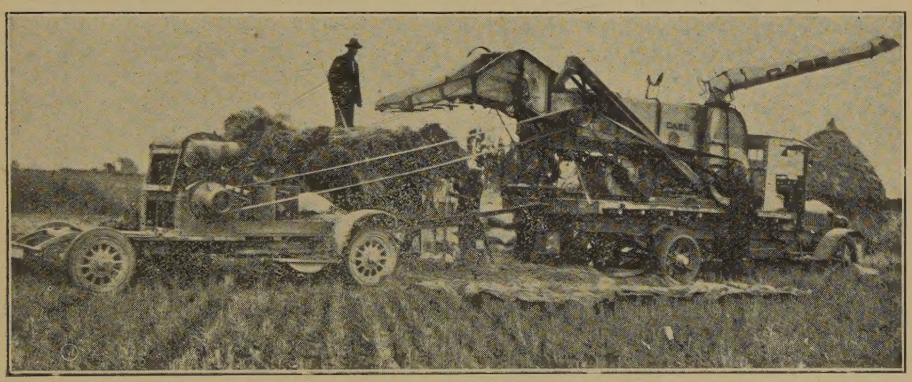


FIG. 4. THRESHING PLANT USED IN THE 1928–29 SEASON.

This plant was highly successful, and, besides reducing the time required in setting and threshing, transport from farm to farm was greatly facilitated. About three times as much work was accomplished in the 1928–29 season as in the previous one, and was also done in a shorter time. On threshing each plot (five to ten sheaves) all the grain is allowed to run out of the machine before the next plot is commenced. The running-out process occupies about half a minute. In good threshing about forty plots (each of seven or eight sheaves) per hour can be put through with ease.

events is generally as follows: Between three and eight weeks after coming through, the super-treated crop grows more rapidly, tillers better, and has a darker colour than "no-manure." Superiority of growth and tillering continues, but the colour of the super crop gets lighter, while the unmanured crop gets darker in colour. This lightening of colour of the super-treated crop probably indicates an outstripping of growth in relation to proper nitrogen-supply, and it is on such crops that nitrogen can be expected to be beneficial. About

November, differences in growth may be hard to detect. In December the crop having super will generally come into ear a little earlier, and this position is usually maintained until the crop is mature, when, apart from stage of maturity, differences may be difficult to observe.

Effect of Early Maturity caused by Super on the "Sample" or Size of Grain.

The effect of manures on the size of the grain is being investigated in connection with all trials, and, although no report has yet been published, all evidence to date indicates that superphosphate-treated wheat has a heavier grain than wheat not manured.

No Evidence that Manuring with Super causes Lodging on Heavy Soils.

So far as could be determined in the experiments on those soils where there is a tendency for the crop to go down at harvest-time, the use of super does not cause the crop to lodge any worse than where no manure is used.

Effect of Soluble Nitrogenous Manures on Appearance and Maturity of Crop.

About one month after application the colour of the crop darkens considerably, and an increased growth may occur. This persists until the crop comes into ear, which it does at a *later* stage than crops having no nitrogen. This lateness is not observed at maturity. In fact, a superphosphate crop responsive to applied nitrogen generally ripens a day or two earlier even than one having superphosphate alone. Hence nitrogen reduces the time between the coming-into-ear stage and the ripening stage by a few days.

More Common Forms of Soluble Nitrogen on the Market in New Zealand.

These fertilizers, together with their respective percentages of soluble nitrogen, are as follows: Nitrate of soda, 15·5 per cent.; Nitro-Chalk, 15·5 per cent.; sulphate of ammonia, 20 per cent.; calcium cyanamide, 19 per cent.; Urea, 46 per cent.

The price per ton varies considerably at present. The use of any of the first four is recommended for the wheat crop. It is evident that a form containing 20 per cent. of nitrogen (the essential fertilizing element) is worth more than one containing 15·5 per cent. To estimate the value per unit of nitrogen the price per ton is divided by the percentage of nitrogen. For example, suppose nitrate of soda can be procured at £12 per ton, and sulphate of ammonia at £13 per ton, the following calculations should be made:—

Nitrate of soda, $\frac{£12}{15.5}$ = 15s. 6d. approximately per unit of nitrogen.

Sulphate of ammonia, $\frac{£13}{20}$ = 13s. per unit of nitrogen.

Sulphate of ammonia is thus the cheaper form.

Recommendations to Farmers.

(1) *Use at least 1 cwt. per acre of superphosphate at time of sowing, irrespective of the previous crop.* The use of greater quantities is not intended to be discouraged here, but until increased quantities are tried out no definite recommendations are justified.

Do not be discouraged by the fact that super is a little difficult to drill satisfactorily in damp weather. The drill stars should be removed and scraped at least once a day. The use of slow-acting phosphates is not justified simply because they run through the drill more satisfactorily than super. It is the solubility of super which enables it to act quickly and effectively, and most soluble fertilizers are troublesome to sow on account of the fact that they absorb moisture from the atmosphere in the same way as common salt.

(2) The use of potash on wheat *cannot be recommended* at present. Future work may reveal certain advantages which have not yet made themselves apparent.

(3) *Make a trial dressing of soluble nitrogen in the spring on crops which have been sown with super.* It is considered that not sufficient work has yet been done to warrant recommending a general dressing of nitrogen. Farmers are advised to purchase a few bags of one of the more common nitrogenous manures, and to top-dress a few strips in each wheat-field at the rate of from 1 to 2 cwt. per acre, according to the nitrogen content of the fertilizer used. The crops most likely to show an *easily discernible* response are those which are inclined to be light in colour about the end of August or during September. For trial purposes the quantity applied per acre should not be stinted, because where observation is being relied upon to indicate response the effect of a fairly large quantity will be more easily detected.

Make the application some time in September. This may not be the best time, but until further experimental work is carried out a better time cannot be recommended. Much research is required on such matters as time and quantity of application with the numerous forms of soluble nitrogenous fertilizers.

REFERENCES.

The results of all experiments on which this article is based will be found in various numbers of this *Journal* as below:—

Wheat-manurial Tests in Canterbury. Vol. 30, April, 1925, page 229.

Wheat-manurial Experiments in Canterbury, 1925–26. Vol. 32, August, 1926, page 106.

Ashburton Experimental Farm: Work of the 1925–26 Season. Vol. 33, November, 1926, page 316.

Wheat-manuring Experiments in Canterbury, 1926–27. Vol. 35, September, 1927, page 182, and October, 1927, page 251.

Wheat-manuring Experiments in Canterbury, 1927–28. Vol. 36, May, 1928, page 339.

Field Experimental Methods. Vol. 33, July, 1926, page 6.

(A separate report on the season 1928-29 wheat-manuring experiments will be published in next month's *Journal*.)

CURE OF IRON STARVATION (BUSH SICKNESS) IN STOCK.

PRACTICAL CONSIDERATION AND FARMERS' EXPERIENCE WITH IRON REMEDIES.

B. C. Aston, Chief Chemist, Department of Agriculture.

It is every day becoming more evident that grassland farming must be looked at from two points of view—(1) the production of healthy pasture, (2) the production of healthy stock. Success in the first does not necessarily entail that the animals grazed will be healthy, for it has been proved in several countries that it is possible to have pasture which is healthy and normal in itself, but which fails to sustain health in the stock when grazed upon it in a manner generally found to be successful for the country concerned. In New Zealand, and probably also in other countries, this anomaly is more frequently found on abnormal soils such as the lighter volcanic loams, dune-sands, pumice-sands, and gravel soils of a light nature and coarse texture, easily leached and very subject to become dry in periods with a rainfall below the average.

On many of these lands the ordinary pasture-plants grow well, without showing any signs of disease or lack of vigour, but ruminants fail to thrive normally or to give normal yields of produce; and on the worst types of soil all the ruminant stock invariably die if not changed to pasture known to produce healthy animals, or if food supplementary to the pasture or medicine is not given. The present explanation of the puzzle is that some mineral food is not present in the pasture in sufficient quantity for the animal eating the grass as a sole ration, although obviously such mineral is present in sufficient amount in the pasture for itself. For instance, the text-books state that although iron is necessary to plant life the merest traces only are necessary as plant food. The animal's point of view is here forgotten, for it has been abundantly proved that pasture with an iron content much lower than normal is insufficient as a sole diet for ruminants.

Thus the pasture may be healthy with but a trace of iron in its composition, but the quickly-growing ruminant or pig with a comparatively high demand for food iron cannot thrive, becomes anæmic, and eventually dies. This reminds one that modern grassland farming is based on the fact that pasture-plants are able to take up much more mineral food than they actually require. If it were not so it would be impossible for the dairy cow to obtain in the bulk of food it is possible to consume daily the minerals necessary to enable her to produce the high milk-yields now common. Some farmers seem to have the opinion that all elements required by the animal should be fed to it through the grass—that is to say, that the feeding of a lick to supplement the minerals present in the natural food is an unnatural or illegitimate method. This opinion appears to be a fallacy, but it is one which might be discussed with profit to all.

One of the most widely used minerals in stock-feeding is sodium chloride (common salt), and although used with certain crops (mangels, &c.) it is not generally used as a grass-manure; yet herbivorous

stock should always have access to it. There are some elements necessary to life the effect of which is to improve the yield of pasture, chief of which is phosphorus (applied as phosphates). There are other necessary elements which increase the health and vigour of plants, and on some soils their yield, such as calcium (as lime salts) and potassium (as potash salts). There are other necessary elements which do not visibly increase the health or the vigour of pasture-plants or their yield, such as iodine and iron. It is these, when deficient for stock in the pasture, which it will probably always be found desirable to feed to the stock direct. It would certainly be difficult to distribute iodine to the pasture in such a way that without undue loss the stock would get the full advantage from the amount distributed, unless it became usual to use Chilian nitrate of soda. This contains a comparatively large quantity of iodine as an impurity, and therefore not charged for.

At present it will be logical to adopt the quickest method of keeping stock healthy on "bush-sick" lands by giving iron medicinal salts as pellets, lick, or drench, or added to drinking-water or feed-milk. Top-dressing the pasture with phosphates containing iron will certainly enable stock to be carried longer than without such dressing, even on the worst soils. The best mixture for this purpose is one of equal parts of basic slag and superphosphate. Basic slag is the only commercial phosphate containing iron in appreciable amount, and, like the iodine in Chilian nitrate, it is not charged for. This slag-super mixture has been constantly advocated by the writer for many years. With turnips it is an excellent fertilizer, and it has given the largest crops of turnips ever grown at the Mamaku Demonstration Farm. The fundamental treatment necessary to convert coarse pumice lands into profitable farms is undoubtedly the incorporation of more organic matter in the soil by the ploughing-in of green crops such as blue lupins. Experiments by the State Forest Service at Whakarewarewa, and on the coarsest type of pumice soil, have shown how the quality and productiveness may be increased by this method. The organic matter or "humus" is calculated to assist in decomposing the pumice particles, and the cultivation supplies the necessary compaction of the soil. The final result is the formation of a soil which holds the water, instead of one which suffers from drought and excessive drainage. The successful farming on pumice types at the prison camps at Hautu and Rangipo must in large part be due to the organic-matter content of the black soil which often lies directly on coarse pumice.

Farmers in the pumice region are becoming more familiar with the practice of using the preparation known as citrate of ammonium and iron—the Ferri Ammon. Cit. of the druggist—which is now sold to *bona fide* settlers by the Department of Agriculture at 2s. 6d. per pound. This substance is supplied in the form of brown scales, which readily dissolve in water, and can then be sprinkled on dry rations in the bails for dairy cows, added to the milk food for calves, or mixed with molasses, salt or green bone, or a mixture of these, for store cattle. With each lot sold a leaflet giving the authoritative methods of coping with "bush sickness" is provided. Some farmers have intensified the treatment—that is, they have given larger doses—with apparent success. One farmer has used a new compound supplied by the Department's Chemical Laboratory—the finely ground native carbonate

of iron known to mineralogists as spathic iron-ore, obtained locally—and has cured three cows which were "sick." This is a substance insoluble in water, and there will not be so much danger of giving an overdose as with the scales.

Abstracts of Farmers' Testimony.

In January of this year those farmers who had previously purchased iron and ammonium citrate scales from the Stock Inspectors at Rotorua and Tauranga were asked by circular to give their experience, since the reports received last year were favourable. (See *Journal* for May and June, 1928.) A number of these replies, which represent the latest information available, have been abstracted, retaining so far as possible the farmers' own wording, and are here published.

District D: From sea-level to about 200 ft.; only mildly "sick."

Farmer "L" has had experience with "sick" sheep, and finds it takes about six doses to effect a cure. He successfully uses the scales in the feed-milk for calves, and finds it a good tonic for cattle.

Farmer "V" finds the use of the scales as a drench generally increases the milk-yield from the treated cows. It takes from six to thirty days before a beast shows improvement under the treatment. He is very pleased with the drug and the reasonable price charged for it.

Farmer "F" has had good results with sick cows and calves. After dosing with the scales from three weeks to a month he noticed a sick cow begin to fill out and go ahead. After this he gave each cow 1 lb. of the scales with the same good results. He uses it successfully in the feed-milk for calves.

Farmer "W" finds the method successful with cows and calves, the period of treatment with the scales being from three to four weeks.

Farmer "B" has found the method satisfactory with sick cows, about a fortnight's treatment being sufficient. He mixes the solution of the scales in water with molasses and sprinkles it on hay. He finds this method of keeping stock healthy much cheaper than changing them on to healthy country.

District E: Coastal and slightly elevated country; slightly sick.

Farmer "D" finds the calves are very fond of the scales dissolved in the skim-milk, and they are all doing splendidly.

Farmer "McG" finds that the scales have done good dissolved in the drinking-water, and thinks that the treatment has had a good effect in increasing the yield of milk.

Farmer "G" has found the use of the scales efficient for cows and sheep. The length of treatment necessary to effect a cure was about fourteen days. Given to cows in water-troughs, the remedy has a beneficial effect on their health generally. He finds it a better and cheaper method than changing to healthy country.

Farmer "V" is quite convinced that the iron treatment is beneficial, especially for calves.

Farmer "M" is of the opinion that the use of iron-ammonium-citrate scales is the surest and quickest road to success, and feels confident

that with a plentiful supply of iron any of the sick country could be farmed successfully. He has tried and constantly used the scales, and his experiences have previously been given in this *Journal* (see page 317 of the May, 1928, issue). Now, after another ten months' experience, he is still using large quantities of the drug. For animals that are sick he uses 2 oz. of solid scales as a drench each day for eight days. Before completion of the dosage the milk-flow will have increased, and both condition of animal and milk-flow will improve for about three months; cows will remain healthy for one to two years. The use of small quantities in the milk food of calves has enabled him to gain all the first prizes in Friesian calf classes in his locality at the shows. He considers the iron treatment far superior to the method of changing to healthy pastures, for the benefits are immediate and procurable just when wanted, as the cows usually "take sick" just after calving, while change paddocks are slow, expensive, and inconvenient. He has adopted the treatment on his whole herd of 120 cows, and although involving a little trouble it has paid him handsomely.

Farmer "A" used the iron scales for treating sick calves, and effected a cure in three weeks. He thinks the method much cheaper than changing.

District F: About 900 ft. above sea-level; sick country.

Farmer "M" (see also *Journal* for May, 1928) makes the valuable observation that of forty-seven cattle thirty-seven took scales readily when mixed with green bonedust, but when mixed with steamed bone only nine took the mixture. This information may prove of great value in connection with supplying a mixture which is palatable to the majority of cattle. With a salt and iron carbonate mixture supplied by the Department Farmer "M" cured three sick cows. This is the first instance of a cure being effected by the local iron compound obtained from the quarry and merely ground up. This farmer has not changed any stock for two years.

District G: Near sea-level, but inland situation; slightly sick country.

Farmer "L" has used the drug for sick calves in the milk, the length of treatment necessary generally being about six weeks, but it depended on how low in condition the animal had got. He found that the scales given with molasses and a little salt gave the best results, and were relished by the animals — "in fact, some of the yearling heifers would open their mouths for the bottle as soon as I got near them."

Farmer "M" successfully uses the scales as a lick mixed with bonedust, salt, and molasses, and as a tonic for cows in low condition in the spring, also as a drench, and dissolved in the skim-milk for the calves.

Farmer "C" gives the scales in molasses to cows and calves, and finds that three weeks' treatment effects a cure in a bad case, although he usually treats an animal until it attains full condition again. He gives 2 oz. of a 10-per-cent. solution to each calf in its milk daily, and his calves and yearlings are splendid. He also puts the scales in the water-troughs—2 oz. to 300 gallons of water. He attributes the

favourable calving and strong calves and good condition of his herd this season to the iron scales put in the drinking-water last autumn and winter.

District H: 1,760 ft. above sea-level; very sick country.

Farmer G confirms his testimony given in the *Journal* for June, 1928 (page 403).

Farmer "B" finds that a fortnight's treatment with the scales is generally necessary to effect a cure in cows and calves; to the latter the drug is given in the milk feed with good results. Although he lives in a very sick district, he has not changed his cows on to healthy pasture for about four years, and all the scales he uses is 4 lb. a year for fourteen cows. He gives them a total of 2 lb. mixed in bran when they come in, and another 2 lb. just before he dries them off, and has had no trouble whatever.

District I: About 1,000 ft. above sea-level; very sick country.

Farmer "B" has had good results from dosing two cows with the scales given in eight doses spread over about two weeks.

District J: About 600 ft. above sea-level; sick country.

Farmer "P" continues his experiences (*Journal* for June last, page 403), and finds that putting the scales into the drinking-troughs is the best way of administering it for cows, and in the feed-milk for calves. For cows it takes from three weeks to two months to effect a cure, depending on how far the animal has gone back. The scales are also fed in the bails in a dry ration. For the trough method ½ lb. of the scales is dissolved in water and put in each trough every two weeks during summer for thirty-six cows. The treatment has been entirely successful for both cows and calves.

District K: Inland situation, 900 ft. above sea-level; sick country.

Farmer "S" fed two calves going back in condition with the scales dissolved in the feed-milk, and effected a cure.

Farmer "D" uses the drug and finds it beneficial in aiding the general nutrition of dairy cows. He writes: "Am always most strongly recommending it; by its proper use and proper farming any land in this district can be successfully handled."

Farmer "W" gives an interesting account of how a grade Jersey cow can become bush sick and practically worthless, and fifteen months later, after "changing," prove to be the second-best dairy cow in the Waikato Show.

Farmer "M" finds that treatment with the scales benefits cows and calves. Most cows benefit by one week's treatment, but some require another week's treatment later. He will always use the drug with his herd. Some cows have doubled their yield. For the calves the scales are dissolved in their milk feed. He considers that there is no need to change if one uses plenty of iron scales—"a godsend to all dairy-farmers if they will dose the cows as soon as they are noticed to be going thin, and use plenty of it."

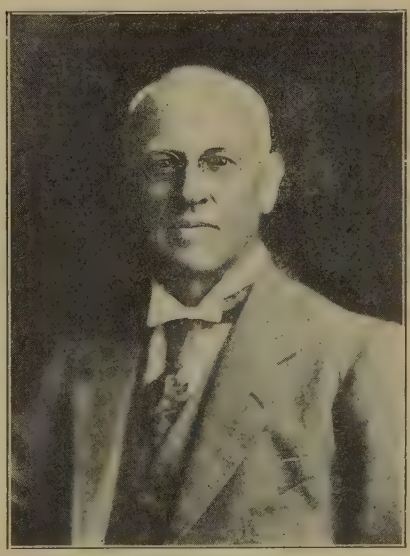
District L: Sea-level, and only slightly affected.

Farmer "M" uses the scales for cows in the water-trough, and for calves in the feed-milk. Sick calves like it and improve very quickly. The drug is put in the trough three times a year for three weeks each time. He thinks it increases the yield of milk and butterfat. This district is a fairly healthy one, but the iron scales push on the "bad doers."

Farmer "T" puts the scales in the water-trough daily for 120 heifers which could get no other water. They kept particularly healthy.

RETIREMENT OF MR. F. S. POPE.

WE record with much regret the retirement on superannuation at the end of March of Mr. F. S. Pope, Assistant Director-General of the Department of Agriculture. Mr. Pope joined the Department some twenty-nine years ago, after a considerable period of service with the Railways, and in 1909 succeeded Mr. J. D. Ritchie as Secretary of Agriculture. In this capacity he headed the Department for about ten years, including most of the difficult period of the War. He was responsible for the reorganization of the Department in 1909, the chief feature of which was the formation of the present Divisions, each under a Director. Several other important developments took place during his regime, and the establishment of this *Journal* in 1910 may also be mentioned. In 1918, when the Government decided that the Department should be controlled by a professional officer, with the designation of Director-General—Dr. C. J. Reakes being appointed to that position—Mr. Pope became Assistant Director-General. Among other valuable qualifications, he possessed a specially intimate knowledge of the many statutes administered by the Department, and was largely responsible for the drafting of these Acts and of the wide range of regulations related to them. This brief notice may fittingly be ended by quoting a remark by the Public Service Commissioner at the farewell gathering, to the effect that he always regarded Mr. Pope as an ideal Civil servant.



MR. F. S. POPE.

WALLACEVILLE POULTRY STATION.

DESCRIPTION OF THE PLANT.

F. C. BROWN, Chief Poultry Instructor, Live-stock Division.

THE Wallaceville Poultry Station is situated on part of the farm attached to the Agriculture Department's Veterinary Laboratory at Wallaceville, in the Hutt Valley, near Wellington. The plant was completed towards the end of last year. The chief objects aimed at in its establishment are as follows :—

(1) To demonstrate modern methods of poultry-management in all branches.

(2) To investigate problems relating to the breeding, housing, and general management of poultry.

(3) To investigate disease, parasitic life, and other troubles affecting poultry. This is carried out in co-operation with the officers engaged at the Veterinary Laboratory.

(4) To supply purebred birds and eggs for breeding purposes from tested stock at moderate prices.

(5) To provide an opportunity whereby the Poultry Instructors of the Department may acquire advanced first-hand knowledge in the various branches of poultry-management, which in turn can be passed on to poultry-keepers during visits of instruction, and also by lectures, demonstrations, and printed matter.

The station consists of about $3\frac{1}{2}$ acres, in which is included an area for the growing of green feed. In addition to the main plant several colony houses are located near by. These are at the edge of a clump of native bush, which provides ideal conditions for the promotion of sound development in the growing stock after they have passed the brooder stage. The site of the station generally is dry and well sheltered, with good drainage, but the ground is rather stony. The wind from the south is broken by a belt of pine-trees, and from the north by natural bush. (Fig. 1.)

It is not intended in this article to do more than touch briefly on matters concerning the plant and stock. It is proposed to include fuller details of construction, together with working-plans, &c., in a revised edition of Bulletin No. 66, "Utility Poultry-keeping," which is at present being prepared. In planning operations the chief object aimed at was to provide conditions which go to make fowls comfortable and promote good health and vigour. The factors of economy in the cost of construction, minimizing of labour in attending to the fowls, and comfort of the attendants in carrying out their work, especially in bad weather, were also taken into account. While the plant presents an attractive appearance, in no section of it has extravagance been introduced.

The buildings are solidly constructed, as should be the case with any permanent structure. It will be seen by the photographs that the whole of the poultry-houses are of the lean-to type, a style which is suitable for the housing of poultry under varied climatic conditions.

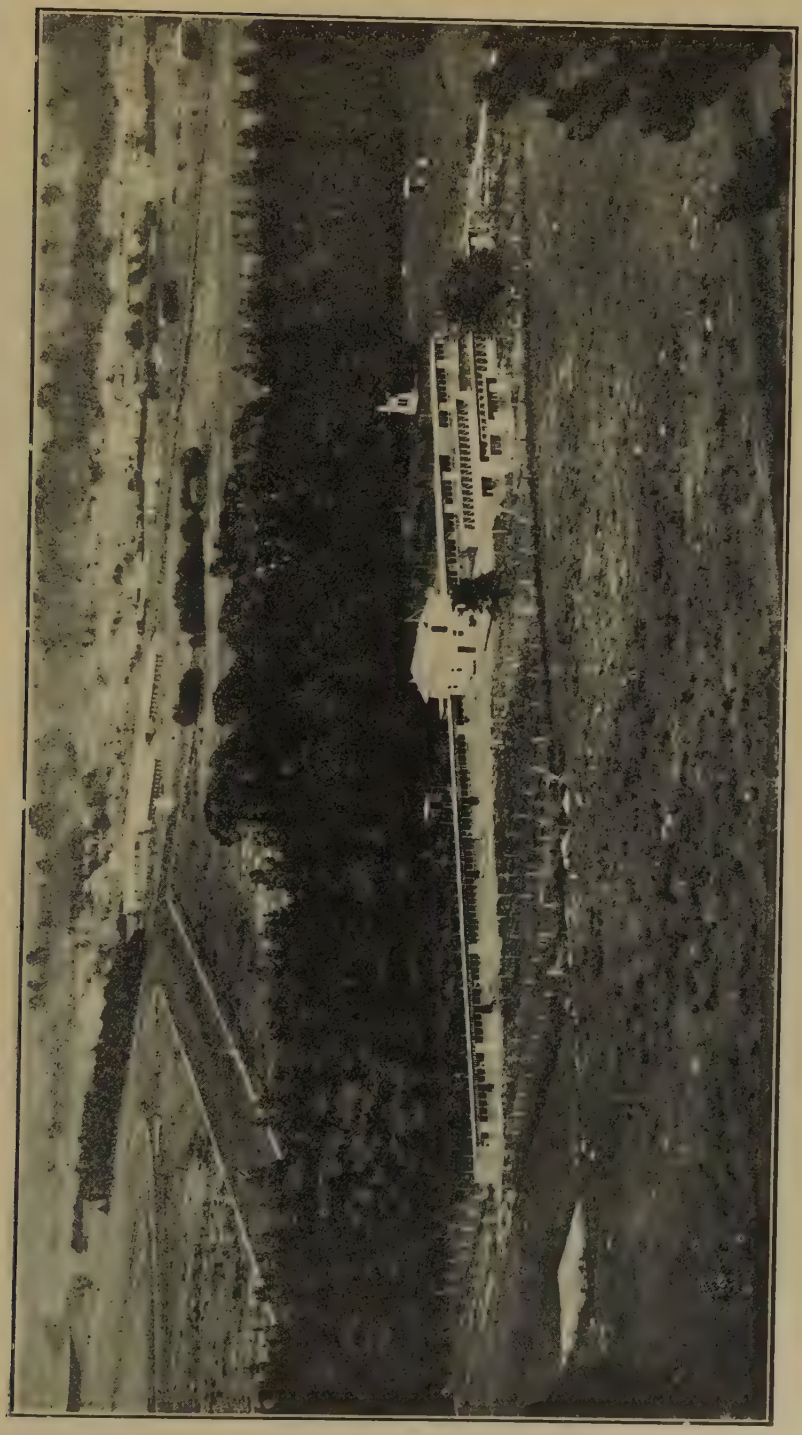


FIG. 1. GENERAL VIEW OF THE WALLACEVILLE POULTRY STATION. [*Photo by H. Drake.*

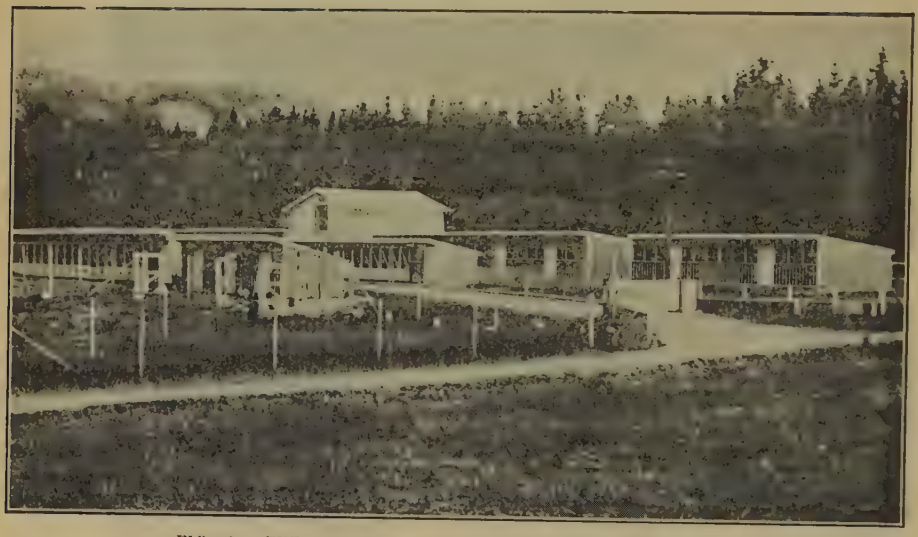


FIG. 2. THE PLANT AS VIEWED FROM ENTRANCE ROAD.

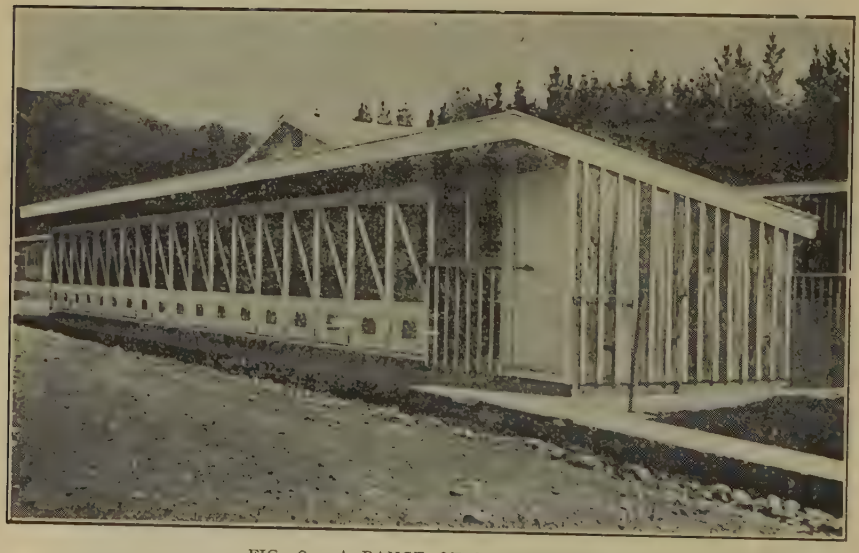


FIG. 3. A RANGE OF SINGLE PENS.

[*Photos by H Drake.*

Fig. 2 shows the entrance to the plant. On the left as one enters are seen the experimental pens (facing outwards), and on the right is a range of single pens (Fig. 3). In each of the latter an individual pullet is placed and maintained for one year. In this way the most desirable breeding specimens are discovered—those which give a heavy production of good-sized marketable eggs. Before the pullets are placed in the pens they are carefully selected according to breed type. In addition care is taken that they conform to standard weight requirements. Thus beauty—in other words, breed type—is happily combined with utility, which should always be the case. The back wall and intersecting partitions are of asbestos slate. The birds are fed, watered, &c., by means of tins which are in turn let in and withdrawn through

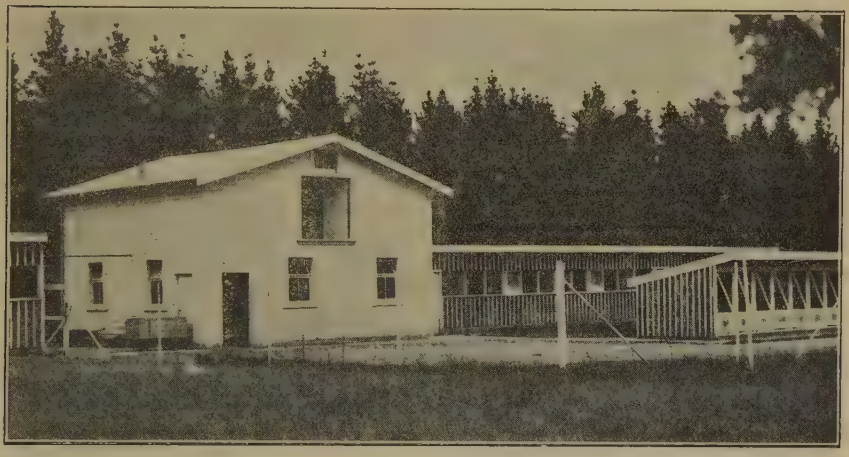


FIG. 4. CENTRAL BUILDING, CONTAINING FEED AND STORE ROOMS, INCUBATING-ROOM, OFFICE, ETC.

[Photo by H. Drake.

the door, and which rest on a shelf fixed to the inside of the door. By this method the work may be carried out without opening the door, and with a minimum of labour.

The first building to be seen at the back of the single pens on the right is a double house used chiefly for breeding-pens. The next section of houses, adjoining the central building, consists of the brooding-quarters, and is divided into compartments to suit the various classes of brooders that are used.

The ground floor of the central building (Fig. 4) is taken up by the feed-room, incubator-room (in which the grading and packing of eggs is also carried out), and the office. The second story provides for a storeroom, grinding machinery (driven by motor power) and bins for holding the various kinds of food used. As will be seen in Figs. 5 and 6, the food is delivered in chutes from the bins to the feed-room below. The sacks of grain, &c., are lifted from the lorry on arrival

FIG. 5. STORAGE-BINS FOR FOODSTUFFS ON UPPER FLOOR OF CENTRAL BUILDING.
Chutes convey the food to feed-room below.

FIG. 6. FEED-ROOM ON GROUND FLOOR, SHOWING, CHUTES, MIXING-TROUGH, BOILER, ETC.

Photos by H. Drake.

by means of a motor-driven hoist. In this process the sacks are swung over the bins, opened, and emptied into them. It will thus be seen that the labour in handling feed is reduced to a minimum.

Continuing, one comes to a range of laying-houses and breeding-pens (Fig. 8), the latter being at the far end. These houses are 20 ft. deep, and are divided into compartments to suit the purpose for which required. The back and intersecting walls are of asbestos slate, which is an excellent material for the purpose. It not only provides a draught-proof wall, which is an essential for the well-being of fowls, but in addition it eliminates harbouring-places for vermin.

SOME PARTICULARS OF CONSTRUCTION, EQUIPMENT, ETC.

Foundations and floors: Throughout the whole of the buildings of the plant these are made of concrete. This is preferred to other materials commonly used for floors—firstly, because the dust nuisance is reduced to a minimum; secondly, because the presence of rats is discouraged; and, thirdly, because disease, parasitic life, and other troubles that affect poultry are more easily prevented and controlled than when earth or wooden floors are used. At all times the floor is well bedded down with straw litter, which not only prevents the fowls from injuring their feet when jumping down from perch or nest, but also provides good exercise for the birds in searching for their grain food, which is fed in the litter.

Roofs and walls: All roofs are covered with corrugated iron. Before the sheets are nailed on, however, and as a means of preventing sweating during frosty weather, 2-in.-mesh wire netting is stretched tightly over the rafters, and on this is placed a good grade of building-paper.

The weatherboards at the ends and front of the building are placed vertically, and the joints are covered with battens. In this way the walls are made draught-proof. To preserve the wood the walls on the outside have been given a coating of Stockholm tar. This, together with the battens, which were painted white before being nailed on, gives the whole a good appearance.

Ventilation: As will be seen in Fig. 8, a portion of the front wall is left open for this purpose and to admit the sun's rays to the interior of the house. An additional space for ventilation is provided between the top wall-plate and the roof at the front of the house. A space is also left open at the back, between the top wall-plate and the roof. This back ventilation-space is so arranged that it can be opened or closed, according to the season of the year and prevailing weather conditions. With this system of ventilation the bad air finds an escape at the top of the front of the house, and is replaced by fresh air from the back. These spaces are covered with small-mesh wire netting to keep small birds out. The brooding-quarters are ventilated in a similar manner. In this case, however, a curtain attached to a light wooden frame is hinged to the plate on the inside of the house above the wire netting. The frames are arranged so as to fit in between the studs, and can thus be hooked up or closed down according to weather conditions.

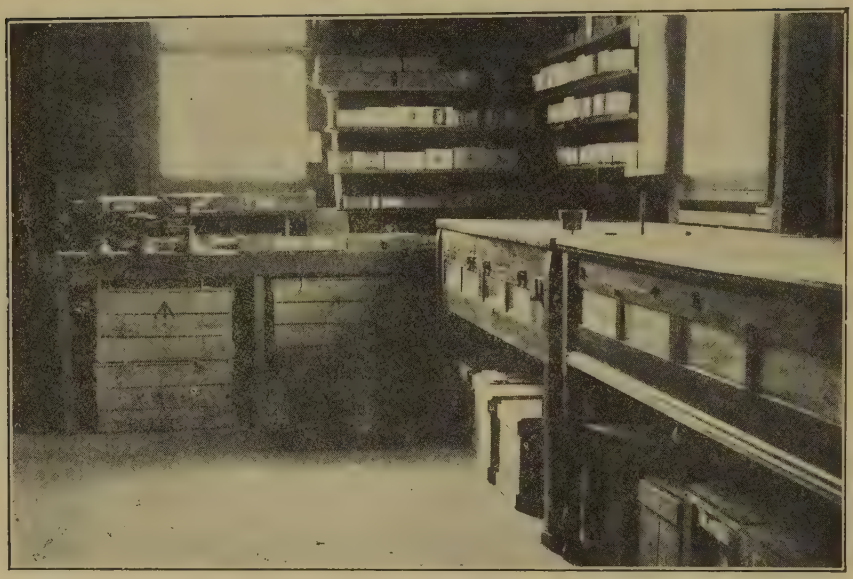


FIG. 7. PART OF THE INCUBATOR-ROOM; ALSO SHOWING EQUIPMENT FOR EGG-GRADING AND PACKING.

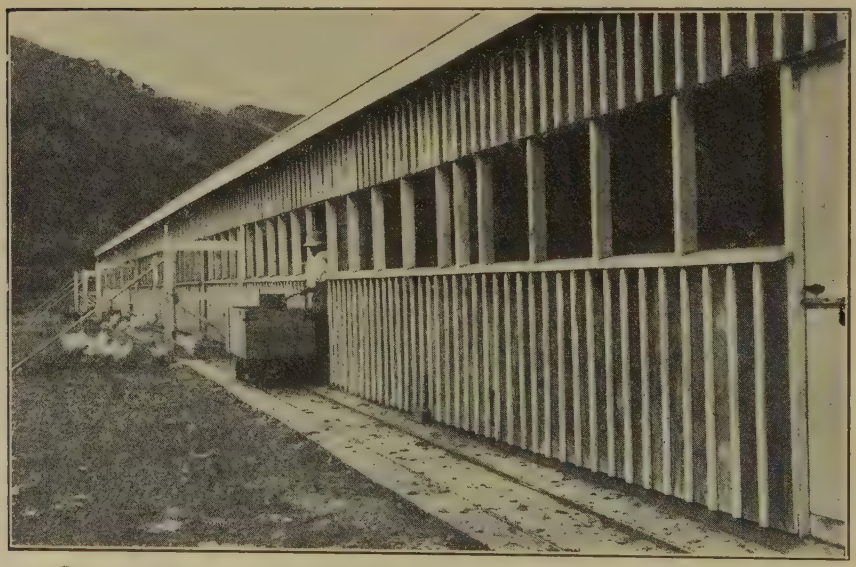


FIG. 8. RANGE OF LAYING-HOUSES AND BREEDING-PENS, WITH SERVICE TROLLY ON RAILS.

[*Photos by H. Drake*

Interior fittings: Fig. 9 shows the interior of one of the laying-houses. The perches are hinged to studs on the back wall, and can be hooked up during the day. By this arrangement the birds are prevented from perching during the day, and are thereby encouraged to take plenty of exercise. Another advantage of having the perches fixed in this way is that it gives a clear floor for the work of cleaning the house and classifying stock, which can be better carried out and in less time than when the perches or their supports are in the way.

As will be seen, the nests are made from petrol-tins with the top and two-thirds of one end removed. A three-cornered piece is also

FIG. 9. PART OF INTERIOR OF A LAYING-HOUSE.
Photo by H. Drake.

removed from the centre of each side to a similar depth as the front. It has been found that by removing the parts referred to from the sides of the tin the hens can see each other when visiting the nests, and they do not crowd into one or more of the latter, as is often the case when these parts are not removed.

The watering of the fowls is done automatically. To the right of the nests in the photo is seen a water-vessel on an elevated shelf against the end of the house, placed sufficiently high to prevent litter from getting in. On the right of this is shown part of a three-compartment broody coop.

Dust-baths are provided in each house. Wooden frames are made in which is placed suitable dusting-material, such as a mixture of sand, ashes, soil, &c.

Service trolly: Fig. 8 shows a trolly run on light rails, the latter being set into the concrete path. The trolly has proved to be of special service in facilitating the work of cleaning the houses. The rails extend to the area used for growing green feed at the end of the section. By this arrangement the manure from the houses is easily transferred to this area, and the green material to the fowls therefrom. The trolly is also found useful for transferring fowl-crates from house to house at culling-time, &c., and for conveying foodstuffs from the feed-room in buckets made from petrol-tins. The ends and sides of the trolly are removable, and are taken off when it is being used for the latter purposes.

Runs: In order to prevent the ground from becoming tainted large runs are provided at both front and back of the houses. In this way they can be used alternatively and allowed to sweeten. The ground taken up by the back runs consisted of a fully grown apple-orchard when the plant was established, and the trees provide ideal shade for the birds during sunny weather. Up to the present the fowls have in no way damaged the trees, and it is expected that in course of time the droppings of the fowls will have a beneficial effect on them.

Fences: These are made of 6 ft. wire netting. For posts (excepting the strainers) discarded locomotive-boiler tubes are used. Holes are made in each at top, centre, and slightly below ground-level. The posts are 12 ft. apart. A well-strained wire is used at the top, centre, and bottom of the posts. As it may be found necessary to renew the posts in course of time, it was considered inadvisable to pass the wires through the holes referred to. The wires are fixed to the posts by short pieces of thin wire passed through the holes. The bottom wire is threaded through the netting to strengthen it, and to enable it to be firmly pegged down with wire staples in a trench 3 in. deep.

GENERAL.

The breeds at present kept at the station are White Leghorn, Black Minorca, and White Plymouth Rock fowls, and White Indian Runner ducks. The question of bringing in another heavier breed of fowls, and also one of ducks, is being considered.

Various makes of incubators and brooders are being tested. Some of both appliances are heated by electricity.

Visitors are invited to inspect the plant on week-days between the hours of 9 a.m. and 3 p.m. On Sundays they are not admitted, except by special arrangement.

Shelter-belts and Atmospheric Conditions.—An important point which is often overlooked when considering the value of shelter on the farm is that of temperature. A calm atmosphere is conducive to humid conditions, and warmth and moisture are essential if a rich succulent growth is to be promoted. There are comparatively few districts in New Zealand which receive more rain than is actually necessary for the growing of crops, and therefore the prevention of evaporation from the soil reduces the necessity for cultivation and mulching.—*State Forest Service.*

INTERNAL PARASITES OF SHEEP AND LAMBS.

SOME NOTES ON PREVENTION AND TREATMENT.

J. E. McIlwaine, M.R.C.V.S., Animal Husbandry Section, Live-stock Division.

Where any class of stock is depastured for a number of successive seasons on the same paddocks, such areas very often become what is termed cattle-sick, sheep-sick, or horse-sick, as the case may be. An interchange of stock is very desirable for this reason alone. Continual grazing of the same class of stock on the same pasture is very liable to contaminate it with the eggs and embryos of the various internal parasites.

There are certain factors in late summer and early autumn which render young stock liable to internal parasites. When lambs are weaned and have to live entirely on grass or supplementary catch-crops there is always a tendency for them to receive a check, and any check at this time is liable to debilitate the animal and allow internal parasites, if present, to badly affect it. The common symptoms shown by parasite-infested stock are debility, anæmia (as shown by a certain degree of paleness of the mucous membrane), scouring, and even emaciation. Associated with the parasites which inhabit the stomach and intestines and are responsible for these symptoms, there may also be a more or less severe infestation of the parasite whose common seat is the smaller bronchial tubes in the lungs. In some cases this particular parasite may preponderate, and the common short cough indicating lung-worm trouble may be the only symptom.

If a post-mortem is held upon such an animal it is usually a very easy matter to demonstrate this worm in numbers in the smaller bronchial tubes. It is not always so easy to demonstrate the stomach worm in sheep. When such proof is necessary it is advisable to kill a lamb which is showing typical symptoms as evidenced by emaciation and diarrhœa. The stomach is then suspended and an incision made along its upper border. The contents may then be seen to be disturbed by a seething movement, indicating the presence of the worms. In some cases the parasites become embedded in the mucous membrane of the stomach, and can only be seen with a magnifying-glass or with the aid of a microscope. In cases where adult worms are numerous, if a needle is taken and drawn through the contents of the stomach some of the parasites cling to it, and can then be demonstrated by transfer to a glass containing water. If the lambs have already been dosed, few parasites may be seen in the stomach. In one case which came under my notice the large bowel and the cæcum contained large numbers of parasites which the farmer had mistaken for partly digested grass-fibres.

Diarrhœa may not be present till the trouble is far advanced, but invariably this is a common symptom. The characteristic cough is perhaps the most frequent symptom when parasites are also present in the bronchial tubes and lungs. The parasites sometimes become encysted in the lungs and set up broncho-pneumonia.

The life-history of all the parasites which infest the stomach and intestines is very similar. The adult lives there, obtaining nourishment from the partly digested food in the alimentary canal or by sucking

blood from the bowel wall. Here it lays its eggs, which leave the body with the dung. Under suitable conditions of moisture and temperature embryos hatch out from the eggs in a variable time, depending on the factors mentioned. These young parasites are capable of an independent existence for a considerable time, so that pastures once infected are likely to remain so for a long period. The parasites are capable of withstanding considerable drought and cold. The dew on blades of grass provides sufficient moisture to enable them to exist, and at night they are thought to leave the grass and seek to bury themselves in the ground, in this way resisting cold, with the exception of severe frosts. It is stated also that the larvæ of some of the parasites can remain over from one season to another; hence the necessity of dosing lambs and young stock early and as often as possible, to prevent the spread of the parasites and reduce the contamination of pastures to a minimum.

It is very probable that the adult sheep acts as a carrier of the parasites, and although able to contaminate pastures does not itself become seriously upset on account of its greater powers of resistance. On the other hand, the young lamb—more especially if it receives a check at this time of the year—having a lower power of resistance and requiring all nourishment available to build up a growing frame, is an easy prey.

All lambs, whether on infested land or not, will pay for careful attention, first to prevent a check, and secondly to ward off parasitic attack. Many farmers make it a rule to dose all lambs soon after weaning, this being repeated later on, depending on the appearance or otherwise of symptoms of parasites. A frequent change of pasture of a nutritious and easily digestible nature is much desired. Long coarse grass is quite unsuitable—in fact, dangerous—as sheep-feed; moreover, such pasture, on account of its retaining moisture better than short cropped grass, is an ideal ground for the spread of parasites. On recently visiting a farm where lambs were scouring badly, and where there was no doubt that parasites were playing havoc, the feed was found to be of this nature. Where sufficient cattle are not available to eat off all such roughage the grass should be mown if a mower can be used. The young green sward of grass, either following mowing or following cattle, is excellent sheep-feed and the feed so much needed for lambs if a check is to be avoided. Excellent results are generally obtained by dairy-farmers who make a habit of buying cull lambs, either to fatten or for their own use, and who graze such lambs in paddocks eaten down by the dairy-cattle. The explanation is, firstly, that the pasture is not sheep-sick and does not contain parasitic larvæ, and, secondly, that the short growing feed is highly nutritious, having a high protein content.

As regards the actual dosing and treatment, there are various agents which are more or less effective in getting rid of the parasites. The Live-stock Division recommends the use of a 1-per-cent. solution of copper sulphate (bluestone). To make this up take 1½ oz. of finely powdered bluestone and dissolve thoroughly in 1 gallon of water, which gives exactly a 1-per-cent. solution.

Lambs can be given 1 fluid ounce, hoggets 1½ oz. to 2 oz., and ewes 3 oz. of this solution. An ounce equals about two tablespoonfuls. Care

should be taken to see that the bluestone is thoroughly dissolved and mixed before dosing, as any crystals escaping have a caustic action, and would therefore cause harmful results in an animal whose stomach and bowels were already inflamed by the presence of the parasites. All animals require to be fasted for at least twelve hours before dosing, and to obtain the best results it is not advisable to hurry the sheep back to pasture. After the administration of the copper-sulphate solution four or five hours should be allowed to elapse.

Lambs and sheep can be dosed every three or four weeks over a period or throughout the year, commencing in the case of lambs immediately after weaning. Pregnant ewes should not be dosed within two weeks of lambing. But it must be fully realized that medicines alone cannot always be relied upon to prevent parasitic trouble. Careful attention to the feeding conditions is the most valuable and necessary measure.

Preventive measures against internal parasites include if possible complete change of pasture. The sheep must be removed from the contaminated area, and, if the infestation is a very severe one, it is advisable to graze the area with horses or leave it vacant for not less than a year. Infested pastures may as an alternative be ploughed and cultivated, and the crops fed off by sheep. Drainage, liming, and the use of salt licks are also indicated as means to be resorted to in combating the persistence of eggs and embryos of the worms. The sheep should be dosed before being placed on fresh pasture, otherwise this in turn will soon become heavily contaminated. If possible extra feed (particularly in winter-time) in the shape of a daily ration of crushed oats, chaff, or concentrates should be fed from troughs. An allowance of hay fed from racks is also advisable, and oaten chaff is very valuable. At first sheep, and more particularly lambs, may not take to this dry feeding; there is often difficulty when green feed is abundant. Nevertheless, the absolute necessity of giving some supplementary feed in addition to dosing with medicine must be recognized. A certain amount of good can be expected from the use of medicines, but unless this is supplemented with good food the best results will not be obtained.

A few remarks may be devoted to the parasites which infest the smaller bronchial tubes, and which are the cause of what is commonly called "lung-worm" in sheep, or "husk" and "hoose" in calves. In the case of sheep it is not desirable that special treatment should be given for this particular parasite, the stomach worms being by far the more harmful in their results. It is sufficient to treat sheep for stomach parasites and to build up their constitution with good nourishing food to enable them to throw off the worms which invade or infest the lung. Medicine given by the mouth has very little, if any, effect on the lung parasites, although in the treatment of calves for this complaint turpentine in milk or oil is frequently given.

Salt licks are given for a number of stock troubles, and for internal parasites such licks as a rule contain sulphate of iron among other ingredients. Sulphate of iron is a valuable aid to other lines of treatment already mentioned, being a good tonic, and assisting in warding off the anæmia which is so common in all parasitic affections.

In these notes I have referred more particularly to the small round worms which infest sheep, and it must be emphasized that these are the

most dangerous. There are a number of flat worms which also infest sheep — namely, the tapeworms and the liver-fluke. The tapeworms, although they present a rather formidable appearance when seen in a post-mortem examination, are not nearly so dangerous as the small round worms to which chief attention has been given. Liver-fluke is very localized in its distribution in New Zealand, and has been the subject of several special articles in the *Journal*. The control measures advised have been attended with very encouraging success where efficiently carried out.

SALTY SOILS IN CENTRAL OTAGO.

A CHEMICAL STUDY OF THE SO-CALLED ALKALI PATCHES.

A. D. Collins, B.Sc., Chemistry Section, Department of Agriculture.

In dry districts generally, as a result of the low rainfall, percolation through the soil and subsoil into the underground water system is not sufficient; and owing to the constant weathering of rocks, salts are produced which tend to accumulate in the subsoil. These salts are dissolved by the water remaining in the subsoil, and the resulting solutions rise to the ground surface by capillary action, evaporate under the heat of the sun, and leave a deposit of various salts which destroy all vegetation and cause sterility.

Capillary action may be brought about by sharp heavy rainfalls, which make a connection between the salty or saline subsoil water and the evaporating ground surface; or by irrigation, which drenches the ground and raises the natural watertable nearer to the ground surface; or by seepage waters, which rise to the surface in the dry basin area below the source.

This deposition of salts — called saline or alkaline efflorescence — sometimes occurs through continued evaporation of ordinary river or spring water, whereby harmful matter accumulates on the surface or the banks.

There is a constant tendency for these sterile spots to spread, especially under the influence of faulty irrigation, and the only remedy applicable is the building of drainage-channels at a lower level than the irrigation-channels, thus producing an artificial means for the percolation of salts not removed by the crops through the soil. Any loss of water by this system is amply repaid by the increased fertility of the soil.

The composition of these salts varies; sodium chloride (common salt) generally predominates, and, with the sulphates of sodium, magnesium, and calcium, forms the material called "white alkali." Sometimes the efflorescence is alkaline in solution and contains carbonate and bicarbonate of sodium. This solution dissolves some of the soil humus and also resolves some clay material into fine particles, so that when dry a hard-pan known as "black alkali" results. Among the causes of sterility the poisonous action of certain inorganic salts, such as sodium chloride, sodium sulphate, and magnesium sulphate, is one of the most

perplexing. Agriculturists are mastering the peculiarities of aeration, lime-deficiency, and texture variations due to want or excess of water, but the true factors governing the relationship between salts, soil, and plants cannot be expressed with any precision. So far, a limited number of plant-poisons have been considered, and their action is most variable; the degree of toxicity of different poisons is not the same, and the poison varies in the intensity and nature of its action on different species of plants.

Compounds of arsenic, copper, and zinc in any concentration do not seem to stimulate growth, whereas very dilute solutions of manganese, boron, and magnesium compounds decidedly increase growth. Even here the action is specific for one poison and one plant; magnesium stimulates the growth of barley, while boric acid is far more potent for peas. It seems certain that some inorganic poisons act as stimulants when present in small quantities, and others, while stimulating certain functional processes, may inhibit other associated processes. Any hindering-action is due to the relatively large proportion of them in the soils, as it has been shown that most of these toxic salts are highly beneficial if the dilution is sufficiently great. Carbonates are more injurious to vegetation than neutral salts; 0·1 per cent. sodium carbonate is toxic to most plants. Most farm crops will tolerate up to 0·25 per cent. sodium chloride in the soil, but the real danger of sodium chloride is in its attack on the double silicates of the soil, lime in particular being displaced, and the clay becoming deflocculated and remaining suspended in water for a considerable time. A comparative excess of magnesium salts over calcium salts in the soil will result in sterility; soils derived from the serpentine (which contains magnesium salts) are notoriously poor.

Referring to samples of salty soils from Galloway, Central Otago, B. C. Aston wrote in 1926: "American investigators have shown that salts of magnesia have, even in solutions of great dilution, a great toxic action on plant-roots, which is much diminished if calcium salts are present at the same time. In this case analysis shows calcium sulphate to be present, but this is much less soluble than magnesium sulphate, which might be largely in excess in the thin surface layers of soil where the salty matter is deposited. . . ." As long ago as 1909 Mr. Aston reported on a similar type of sterile soil from Nelson: "There is no doubt that many of these Nelson soils which are unproductive owing to excess of magnesia might be brought into much better condition by applications of gypsum (calcium sulphate). . . ." (Annual Report, N.Z. Department of Agriculture, 1909.)

While in some of the present analyses of the surface scrapings a high percentage of sodium chloride is shown, the quantities of magnesium, calculated as oxide, are also considerably above the concentration known to be toxic—that is, about 0·5 gramme in 100,000 parts of water. In these cases, then, it may be justly inferred that toxicity is due not simply to the sodium chloride (which would definitely be shown in the deflocculated nature of the soil), but largely to the magnesium excess over the calcium. To bring this out more clearly the surface scrapings of the salty efflorescence were analysed, and the accompanying tables indicate this point.

Table 1.—Surface Scrapings of Salty Soil Areas.

Lab. No.	Colour of Sample.	Locality.	Nature of Sample.	Moisture per Cent.	Loss on Ignition per Cent.	Soluble in Water.		Soluble in Hydrochloric Acid.	
						Mineral Matter per Cent.	Organic Matter, &c., per Cent.	Mineral Matter per Cent.	Organic Matter, &c., per Cent.
Y									
196	Grey ..	Alexandra, Poolburn ..	Salty surface of soil ..	0·0154	0·0482	3·27	5·49	5·71	14·59
197	Light grey	Alexandra, Tiger Hill ..	Salty incrustation in decomposed schist	0·0076	0·0391	5·59	7·04	39·35	19·51
198	Light brown	Alexandra, Tiger Hill ..	Salty patch on alluvium ..	0·0082	0·0308	3·62	4·43	6·21	16·38
199	Light grey	Alexandra, Leaning Rock S.D.	Salty incrustation in decomposed schist	0·0092	0·0954	14·85	19·55	28·17	13·64
200	Light grey	Alexandra, Leaning Rock S.D.	Salty efflorescence ..	..	0·0080	12·20	..	4·75	12·32
201	Brown ..	Cromwell, Wakefield S.D. ..	..	..	0·0834	12·47	13·55	7·43	14·34
202	Light grey	Alexandra, Wakefield S.D. ..	..	0·0183	0·1010	7·28	9·14	8·70	13·72
203	Brown ..	Cromwell, Wakefield S.D. ..	Black salty soil	0·0092	0·0977	4·19	10·02	8·26	26·06
204	Grey ..	Cromwell, Wakefield S.D. ..	Black salty soil	0·0028	0·0435	3·40	7·32	6·66	16·19

Table 2.—Percentage Mineral Content of Water Extract.

Lab. No.	Magnesium Oxide. MgO	Sulphate as SO_3	Chloride as Cl	Silica. SiO_2	Calcium Oxide. CaO	Alkalies. Na_2O, K_2O
Y						
196	0·005	0·47	1·66	Trace	0·38	1·05
197	0·20	0·54	0·11	Trace	0·24	0·72
198	0·26	0·19	1·37	Trace	0·10	0·68
199	0·10	1·18	0·66	Nil	4·35	3·42
200	0·23	1·33	1·18	Trace	0·19	5·74
201	0·18	0·75	2·50	0·04	0·80	4·97
202	0·003	0·56	0·27	Trace	0·0009	3·91
203	0·52	0·03	0·37	Nil	2·21	0·89
204	0·097	0·12	0·14	Trace	0·0004	2·39

Table 3.—Comparison between the Bases (Water-soluble).

Lab. No.	Magnesium Oxide. MgO	Calcium Oxide. CaO	Alkalies. Na_2O K_2O
Y			
196	0·35	26·48	73·17
197	17·24	20·69	62·07
198	25·00	9·61	65·39
199	1·27	55·27	43·46
200	2·88	54·37	42·75
201	3·03	13·44	83·53
202	0·08	0·02	99·90
203	14·36	61·05	24·59
204	3·89	0·02	96·09

Table 4.—Magnesia calculated as Sulphate (Water-soluble).

Lab. No.	Anhydrous $MgSO_4$	Crystalline $MgSO_4$ $7H_2O$
Y		
196	0·014	0·029
197	0·60	1·22
198	0·78	1·59
199	0·29	0·60
200	0·69	1·41
201	0·54	1·10
202	0·009	0·018
203	1·55	3·18
204	0·29	0·59

In samples 198, 202, and 204 the magnesium is sufficiently in excess of the calcium to be poisonous to plant-growth, and samples 196, 197, 198, 202, and 204 have a very high sodium content. Whether this latter is chiefly present as chloride is difficult to discover. Analytical figures for such soils are hard to refer or arrange as combined acid and base radicles—that is, as definite compounds. Therefore, not knowing the true nature of the salt present, it would also be impossible to state that the calcium exists there in a form which inhibits or restrains the toxic effects of magnesium salts. It seems likely that in most of the soils studied in this connection the magnesium plays the most important role as toxic, while the sodium chloride brings about a degradation of the soil and further accelerates the formation of the efflorescence.

The quantity of salt present is now recognized as of hardly so much importance as its physiological action and its influence in association with other salts. It is conceivable that sodium and potassium salts catalyse or make possible the effects of other salts, and thus bring about a peculiar condition which may be either toxic or stimulative, according to the nature of the plant, the soil, and the climate.

Effect of Shelter on Farm Crops.—The following description of two typical instances recently observed on the Canterbury Plains will serve to illustrate the effects of shelter on crops. A field, completely protected from the north-west with the exception of one corner, was carrying a magnificent crop of oats. In three days a gale thrashed the exposed corner to the ground, while the sheltered crop remained unharmed. Along the same road there lies a big grazing-paddock, one half of which is protected by two fine belts of trees from the north-west and south-west. The owner has been recording the variation in feed-value between the two sections of this paddock, and for this reason has been very careful to fertilize and stock the whole area uniformly. Past records show that originally the whole area was of equal soil-quality, but to-day there is a remarkable difference, for on the sheltered end the valuable fodder grasses have formed a fine sole, while on the exposed end there exists little but native grasses and weeds, the line of demarcation being quite clear. This clearly demonstrates that the finer grasses cannot thrive when exposed to parching summer winds and cold blasts of winter, but that the effect of both these conditions may be overcome by careful and thoughtful planting.—*From State Forest Circular No. 25.*

THE FERTILIZERS ACT AND REGULATIONS.

REGISTRATION AND OTHER PROVISIONS.

F. T. LEIGHTON, Analyst, Chemistry Section, Department of Agriculture.

THE Fertilizers Act, 1927, came into force on 1st June, 1928, and necessary regulations under the Act were gazetted on 4th October following. A summary of the main points of the new Act appeared in the *Journal* for December, 1927. As all registrations of vendors and brands of fertilizers must be renewed in the month of June, the time is opportune to review briefly the requirements of the Act and regulations for the information of manufacturers, traders, and users of fertilizers.

The Act defines "fertilizer" as any substance used for enriching the soil and in a state suitable and intended for application to the land, and which contains in appreciable amount nitrogen, phosphoric acid, or potash. It does not include lime, stable manure, or crude refuse which has not been specially prepared. *It is an offence to sell as a fertilizer any substance for which a brand could not be registered under this Act.*

All sales of fertilizer in quantities of less than 5 cwt. are exempt from the provisions of the new Act, and traders, such as retail seedsmen and florists, who sell only small quantities of fertilizers, are no longer required to register as vendors.

Registration.

Vendors are required to register their names and addresses in the month of June each year (or before the sale of any fertilizer), and those who are manufacturers, mixers, or importers must deposit a statement describing the brand and composition of each fertilizer, and must receive a certificate of registration of the brand before offering such fertilizer for sale. Vendors who do not manufacture, mix, or import fertilizers will now register in a simplified form. No details other than those of brand, name of fertilizer, and name of manufacturer or importer are required in their case.

The manufacturer or importer is now required to state not only the percentages of the fertilizer ingredients, but the actual percentages of the components (such as super, blood-and-bone, &c.) in the mixture, including the nature and amount of any filler or diluent. On the other hand, he is no longer required to declare "unit values," or the "equivalents" in tricalcic phosphate and sulphate of potash. The term "phosphoric anhydride" has been superseded by the more commonly used "phosphoric acid." Briefly, the particulars to be supplied for registration have been simplified and made more intelligible to the purchaser, who receives a copy of the statement in the form of an invoice certificate with every lot of 5 cwt. or more.

The Act provides that no brand shall be registered if it is the same as or similar to a brand already registered. It is a common practice for traders to have fertilizers prepared or mixed by manufacturers and packed in bags bearing the trader's special brand. A trader might thus have mixtures prepared by several manufacturers, each of whom would apply for registration of the trader's brand.

Under the new Act such duplicated registrations of any brand cannot be accepted. To simplify the procedure, therefore, the owner of any special brand, though he may not actually manufacture or mix fertilizers, should apply for registration of the brand. The manufacturer will then supply the fertilizer to the trader as a sale of "special mixture" in bulk, to be bagged in the trader's branded bags, and the brand will not be registered by the manufacturer. This procedure applies to any case in which a manufacturer mixes fertilizers to order for a trader and does not offer such fertilizers for general sale.

IMPORTED FERTILIZERS.

Importers of fertilizers are required to register in the same manner as manufacturers, and any firm importing a mixed fertilizer should obtain from the manufacturer the necessary particulars of the components. It should be noted that a mixed fertilizer is one in which the components are incorporated mechanically, and not by chemical process. Such a fertilizer as basic superphosphate, in which the lime reacts chemically with the phosphate, is not a mixture within the meaning of the Act, and the necessary amount of lime required to bring about complete reaction is not a "filler or diluent" in this case. In the case of imported fertilizers the overseas manufacturers' brands may be specified in the application for registration, but it should be clearly understood that no importer can be given the exclusive right to any of such brands.

CO-OPERATIVE CONCERNS.

Section 20 of the Act provides for importers or purchasers of fertilizers who are not actually traders. Co-operative dairy companies, for example, import or purchase in New Zealand fertilizers for distribution to their members, and such companies are not vendors as defined by the Act. When a co-operative concern imports a quantity of fertilizer, a sample is to be forwarded to the Chemist, Department of Agriculture, Wellington, with a statement (Form Ag. H./223) showing the particulars of composition, &c. A copy of these particulars is also to be supplied to each person receiving portion of the consignment. The position of indent-agents who transmit orders but who do not actually make sales of fertilizers is also covered by this section. When fertilizers are purchased in New Zealand by co-operative societies a copy of the vendor's invoice certificate is to be supplied to each recipient of the fertilizer, but no sample need be sent to the Chemist.

POINTS IN APPLICATION FOR REGISTRATION.

In completing the form of application for registration (Ag. H./87), attention to the following points will avoid much subsequent correspondence :—

(1) Facsimile of brand : A brand must be supplied for each fertilizer. To offer fertilizer for sale in unbranded packages renders the vendor liable to prosecution. The design of the brand must be clearly shown, but where a number of mixtures are sold under the same general brand it is sufficient to state the brand once only, and to indicate the distinguishing marking or wording in respect to each fertilizer of the series.

(2) The percentages of the fertilizer ingredients are not infrequently entered under the wrong headings. In such cases the forms have to be returned for correction, with consequent delay in completing registration.

(3) Citric-solubility may be stated on the registration form and invoice certificate at the option of the vendor. If it is so stated, the effect is that of a warranty.

(4) Fineness of grinding: This must be stated in the case of basic slag and ground rock phosphate, whether alone or in mixture.

(5) The components (including filler, if any) and their respective percentages must be clearly stated.

(6) In the case of a firm with several branches it is not necessary to make a separate application for registration of each branch. One form showing the various addresses will suffice.

Sampling and Analysis.

The regulations prescribe the methods of sampling and analysis of fertilizers. Under the Act of 1908 the vendor from whose premises a sample was taken for analysis was supplied with a copy of the Analyst's certificate. The new Act cancels this obligation, but permits the vendor to obtain a copy of the certificate on payment of the prescribed fee, which is fixed by regulation at £1 1s. A copy of the certificate is, however, supplied to the vendor without cost if the analysis discloses any discrepancy materially to the prejudice of the purchaser.

The provision in the Act of 1908 whereby a purchaser might, on application to an Inspector and payment of a fee of £2 2s., have a sample taken from a consignment of fertilizer supplied to him has been continued, but the time after delivery of the fertilizer within which notice to take samples may be given to the Inspector has been extended to twenty days. The vendor has the right to be present or to be represented at the taking of the sample, and if the Analyst's certificate shows that there is no discrepancy to the prejudice of the purchaser the vendor may claim from the purchaser his reasonable expenses in attending.

Miscellaneous.

The regulations prescribe limits of error within which the percentages of ingredients of fertilizers may differ from those shown in the vendor's invoice certificate. These limits of error are similar to those of the British regulations, but the former allow rather greater latitude. For most "straight" fertilizers an error of 1 per cent. in phosphoric acid, 0·5 per cent. in nitrogen, and 1 to 2 per cent. in potash is allowed.

The fineness of grinding is to be declared in the case of basic slag and ground rock phosphate, and the regulations prescribe that the standard of fineness through the standard sieve (No. 100 E, made by Amandus Kahl, of Hamburg) shall be 80 per cent. Owing to the necessity of installing special machinery to grind rock phosphate to this standard a fineness of 70 per cent. will be permitted until November, 1929. While the Amandus Kahl sieve has been the standard for basic slag for many years, the British-made sieve known as the 90 I.M.M. (Institute of Mining and Metallurgy) has been recently

tested and found to give practically identical results. This sieve may therefore be used with confidence, instead of the 100 E, where the latter is not readily available.

Where the percentage of phosphoric acid soluble in citric acid (citric solubility) is stated by the vendor, the solubility is to be estimated by the method prescribed in the regulations. By varying the proportions of fertilizer, citric acid, and water, widely-differing results can be obtained; hence the need for a standardized procedure.

Every vendor should be in possession of the Fertilizers Act, 1927, and the regulations thereunder. The Act can be obtained (price 9d.) from the Government Printer, Wellington. The regulations are obtainable gratis from the Chief Chemist, Department of Agriculture, Wellington, and copies will shortly be distributed to all registered vendors.

WOOL RESEARCH.

DR. NICHOLLS'S PRELIMINARY REPORT ON NEW ZEALAND CONDITIONS.

DR. J. E. NICHOLLS, of Leeds, who has been travelling in New Zealand for two or three months in the course of an overseas mission of investigation on behalf of the Empire Marketing Board and the British Research Association for the Woollen and Worsted Industries, completed his itinerary at the end of March. A detailed report by Dr. Nicholls, including a discussion of the various breeds of sheep, will be made available later, after submission to the Board and the Association. In the meantime he has furnished the following general preliminary report to the New Zealand Wool Research Committee:—

Observations on Sheep-breeding and Wool-production in New Zealand.

Ample opportunities have been provided in the course of my itinerary for the careful study of conditions in the sheep-breeding districts, and of stud and commercial flocks of the various breeds; and much interesting information has been obtained. For the purposes of this report certain aspects only will be mentioned.

It would appear that, from the point of view of the standard of the wool-clip of New Zealand, the considerations of greatest moment are those which affect the methods of fat-lamb production—the idea of which has dominated sheep-breeding practice for years. Further, it is probable that increase in sheep numbers will be due largely to increased carrying-capacities of existing sheep-country, and the development of that type of mixed farming in which cattle and sheep are associated in the management of dairy lands.

The problem of wool-improvement, therefore, must be closely invested by the study of sheep husbandry. It cannot be denied that much good would emerge from an educational policy whereby the farmers whose activities lie chiefly in the direction of fat-lamb production (in most cases from a form of "flying" ewe flock) would be encouraged to the use of better stock, better methods of selection, and better preparation of the clip for market. Such a policy could not, however, proceed far without the background of a greater knowledge of wool characters in so far as they constitute the fleece, which must be the unit in sheep-breeding for wool-production.

New Zealand would appear to be well suited to the conduct of sheep-breeding and wool investigations, for the following reasons :—

(1) There are great variations and contrasts in natural environment within comparatively small areas.

(2) There is a great range of sheep types.

(3) The most important breeds, numerically, have rapidly spread over large areas and into a variety of environments, and are yet in a state of flux so far as type is concerned.

(4) The wool product is of great value to the community.

(5) Criticisms of the character of the clip have drawn the attention of breeders to a closer study of their wools.

Research into Problems of Wool-production.

The relation of raw material to its uses in manufacture must be borne in mind in order that defects present in the raw material may be reasonably weighted in their effects on manufacturing value. While all wools can be considered to possess certain defects or faults from the manufacturer's point of view, the breeder is interested in the distribution of such defects in his fleeces and the reasons for their presence. Hence it would appear desirable that close biological study be made of New Zealand fleeces, particular attention being devoted to those characters which are undesirable in manufacture. This would of necessity involve the closest possible co-operation with bodies of workers interested in the commercial utilization of wool products.

A few characters may be mentioned as examples: (1) Length and average diameter, and their distribution in the fleece; (2) variations in diameter and shape of individual fibres; (3) variations between neighbouring individual fibres throughout the fleece; (4) elasticity and strength of fibre; (5) softness of "handle"; (6) density of fleece, and the arrangement of follicles giving rise to different degrees and distribution of density; (7) staple formation—laterally and longitudinally—and crimp; (8) lustre; (9) the presence of intrusive fibres—*e.g.*, kemp; (10) the relation of fleece material to other skin-secretions. These characters cannot be considered as independent; indeed, it may be that the underlying principles of all wool research should be the consideration of the production of amount of fibre material and the character of that material as produced.

It would appear that the important fields to traverse are—

(1) The general growth-rate of the fleece—in all dimensions—dependent upon the activity and distribution of the follicles, which is in turn based upon genetic and nutritional conditions.

(2) The changes in fleece and fibre character with age and inclination to transitory changes in environment.

Within these fields would come, for example, the study of "thickened tip" and similar characters; the establishment of criteria of selection (more important in mutton or fat-lamb producing breeds where early selection of breeding-stocks is most desirable); and the study of the inheritance of fleece characters.

(3) The study of the economic balance between wool and meat production.

The Mechanism of Research.

The precise means of the conduct of experimentation and research can be decided only according to facilities which can be provided within the Dominion; but from the broad point of view it would appear most desirable that a very close co-operation with other research bodies in the Empire, including an interchange of workers for training and subsequent experience, should be considered. This would eventually necessitate the establishment of some central organization within the Dominion from which research, fundamental and applied, on sheep-breeding problems could be conducted.

MOTTLING IN COLOURED CHEESE.

INVESTIGATION AT WALLACEVILLE.

G. F. V. MORGAN, N.D.A., N.D.D., Dairy Bacteriologist, Wallaceville Laboratory.

A NUMBER of sample plugs of cheese have recently been examined by the writer for bacteria which might be responsible for the mottled and streaky appearance of several lines of coloured cheese received at some of the grading-stores this season. The examination has not revealed any organism that would be capable of producing the mottling effect in the pressed curd, either immediately after pressing or at a later date, but some interesting information has been acquired on other aspects of the problem.

In an experiment conducted in connection with openness in cheese, two loaf cheddars were made at a factory on the same day, and treated in the same manner. The first cheese was forwarded to the laboratory immediately after removal from the press. It was carefully packed and well wrapped in parchment paper, and arrived in good order. On arrival the cheese was cut in half from top to bottom. The cut surfaces revealed the usual types of openness, more particularly round the outside, and a very marked mottled appearance. The mottled appearance was much more pronounced in this cheese (directly after pressing) than in the plugs from the cheese received from the grading-stores. The mottling in the first instance followed the outline of the larger particles of curd as they had been pressed in the hoops, and showed a distinct milky-white area round each particle. On cutting the newly made cheese this moist white area was squeezed by the downward passage of the knife, and consequently some of it became smeared over the evenly coloured particles of curd. When the cut halves had been allowed to remain for a fortnight and were then cut into quarters the mottled appearance was still distinctly visible, but was typical of the plugs forwarded from the grading-stores, showing the somewhat faint but firm yellow brown mottling typical of the mature discoloured cheese.

The results of this experiment seem to point to the fact that mottling is due to the expressure of the white fatty whey after pressing, rather than during the last stage of cheddaring. The white moist discoloration that surrounded the particles of curd and became smeared across the newly cut surface of the cheese was identical with the white whey that is lost just before salting in a properly cheddared cheese.

This type of whey is very rich in fat, and also contains a large percentage of albumen and milk-sugar. These two latter constituents form an excellent medium for bacterial growth, which accounts for the fact that decomposition frequently begins in the mottled areas. Bacteria of the lactose fermenting type will work more rapidly in these areas, but if they are of the *Streptococcus lactis* type will do little harm, except perhaps to cause a slightly uneven ripening of the cheese. Putrefactive organisms, however, most of which are capable of breaking down casein, and a very large number of which will have escaped the pasteurization of the original milk, are likely to multiply rapidly in the discoloured areas and to use them as a base for attacking the protein in the better-drained portions of the cheese.

The damage done by these protein breakdown types of bacteria will be noticed much sooner in coloured cheese than in the plain white cheddar, as the colour contrasts when slow liquefaction of the protein is taking place will be greater, and therefore sooner apparent, though the same damage is probably being done in the white cheese. In ripe cheese the discoloured parts are often noticeable not only from their difference in colour, but by the fact that they are becoming spongy and slowly liquefying.

LIME-DEFICIENT AREAS IN KING-COUNTRY.*

TOP-DRESSING EXPERIMENTS WITH SHEEP AT MAIROA.

C. M. WRIGHT, Country Analyst, Mineral Content of Pastures Investigation.

THE object of conducting the field experiments at Mairoa as here described was to demonstrate the behaviour of sheep of various ages on paddocks top-dressed with lime alone, and with a lime and superphosphate mixture containing a great deal more lime than the usual basic super, which had not proved satisfactory previously.

The sheep used for the experiments were bred locally, and were selected as being of the type with which most of the so-called "dopiness" was experienced. No attempt was made to select sheep of even weight or type for each experiment, the idea being to use sheep known to be troublesome to rear and hold, and also to make the results of value for practical purposes both from the points of view of the farmers and the mortgagees; it was specially necessary that they should have confidence in the results.

As it is often a matter of opinion as to how stock are doing and have done when the appearance of them is the only evidence, it was decided that the sheep should be weighed at intervals as regularly as possible, so that the response of each animal would be known. For this purpose numbered metal tags were inserted in the ear. It was found when the weighings were first commenced that it would be necessary to shed the sheep overnight before weighing, so as to have them empty. It is impossible to get constant weights with sheep off pasture, as apparently they have varying capacities, depending on the time of the day, the weather, and their general health.

For weighing-purposes a sack was split down one side and tied at both ends, and the sheep laid on its back on the sack, which was then hooked on to a spring balance. It was found that there was very little struggling on the part of the animal when this method was used, and the weight and number were easily ascertained.

It was also found early in the experiments that most of the bad-doers were infected with internal parasites, and that it was imperative they should be treated for that trouble. It should be clearly understood that this must be done in all cases where the appearance of the animal indicates the presence of parasitic infection; it is not fair

* Useful reference may be made to an introductory article on this subject, entitled "Mineral Content of Pastures: Lime-deficient Areas and a hitherto Unsuspected Malnutrition Disease in Sheep," by B. C. Aston, published in the *Journal* for September, 1928.—*Ed.*

either to the animal or to the malnutrition treatment to expect the latter to effect a spectacular cure and so build up the animal in a short time that the effects of the parasites are nullified. What will very probably happen will be that the animal will be in such a poor state of health that before the more healthy and normal pasture can be effective the parasites will win and the animal die, and the pasture or other treatment will then be condemned as a failure.

The treatment for parasites now being used is to dose the animals with a solution of copper sulphate to which mustard is added (they had previously been dosed with a proprietary arsenical preparation). For this purpose ¼ lb. of fresh bright copper-sulphate crystals is dissolved in some heated water in a jar, the solution is made up to 3 gallons (preferably in an earthenware jar), and a paste of ¼ lb. of mustard mixed with water is stirred in. For a grown sheep 3 oz. of the solution is given, and for a lamb ½ oz. to 1 oz., according to age. Where the sheep are badly infested and the source difficult to remove it will be necessary to dose animals showing signs of infestation once every four weeks. Small metal containers suitable for the drenching may be purchased from ironmongers.

FIRST GROUP OF EXPERIMENTS.

The first group of experiments—lime alone, gypsum, and control—are situated on a high part of the Mairoa district (about 1,200 ft.) and are on country with a "lime-requirement" of about 10 tons carbonate of lime per acre. A 20-acre paddock typical of the affected country and in a central position was fenced, and 38 tons of ground limestone spread on it. This spreading was finished at the end of the first week in January, 1928, and after good rains forty lambs were put on the paddock.

The first weighing was on 24th April, 1928. Six lambs were drenched for parasites on two occasions each, and one on one occasion, during the twelve months. This treatment seemed to be required only at the end of the past year, and may be due to the sheep being on dry pasture and drinking from waterholes that had become stagnant owing to the dry weather. Samples of wool were taken for examination and the weights of the fleeces noted.

In July the paddock was cut into two, so as to give the sheep a change of pasture. In addition to the forty lambs, which had no supplementary feed of any sort, four young cattle were grazing on the paddock till the end of the winter. There does not seem to be any doubt that the carrying-capacity has been improved. Before the top-dressing the pasture was a worn-out one consisting mainly of danthonia, fog, and a little Lotus major, and was badly infested with piripiri and moss; white clover could not be found. Now, at time of writing, after fifteen months, there is a better general colour, cocksfoot, rye-grass, crested dogstail, and white clover are showing up. There is also a rather remarkable feature in that earthworms have made their appearance in numbers, whereas they are very difficult to find on the unlimed country. The worms were first noticed three months after the lime had been applied. About 5 acres has been roughly logged up and burnt, and will be harrowed and sown with fresh grass-seed to see if it is possible to improve the pasture on the easier parts of the country by this method.

Table 1.—Weights of Sheep in Pounds on Limed Paddock (First Group).

No.	24/4/28	11/5/28.	4/7/28.	24/8/28.	2/10/28.	6/11/28.	26/11/28.	Wool, 26/11/28.	10/1/29.	11/2/29.	Dosing.	Total Gain.	Total Gain, plus Wool.
24 (w)	57	58	60	57	58	60	62	5½	55	51	pp	−6	−½
25 (w)	46	44	45	46	41	49	52	4	49	47	pp	1	5
26 (e)	43	46	49	43	53	51	61	4½	64	74	..	31	35½
27 (e)	48	47	49	48	48	53	58	4	61	64	p	16	20
28 (e)	53	52	54	53	53	60	56	3	72	82	..	29	32
29 (e)	46	55	56	46	50	59	56	5	70	81	..	35	40
30 (e)	55	58	58	55	58	66	61	6	80	90	..	35	41
31 (e)	48	50	51	52*	56	64	62	6½	74	78	..	30	36½
32 (w)	45	48	51	45	50	59	56	3½	71	81	..	26	29½
66 (e)	53	55	55	53	57	63	68	5	71	81	..	28	33
34 (w)	56	59	58	56	58	63	60	4	75	80	..	24	28
35 (e)	55	57	59	55	59	59	66	5½	75	86	..	31	36½
36 (e)	50	50	53	50	52	52	57	5	57	66	..	16	21
37 (e)	42	41	51	42	48	53	50	5	65	75	..	32	37
38 (e)	53	56	58	53	57	65	65	4½	76	81	..	28	32½
39 (e)	59	53	59	59	62	66	67	4½	67	74	..	15	19½
40 (w)	56	58	54	56	62	71	68	4½	83	91	..	35	39½
41 (e)	58	57	59	58	50	55	62	4	69	77	..	19	23
42 (w)	49	56	60	49	52	60	56	6	70	77	..	28	34
43 (w)	57	60	61	57	50	60	54	3½	62	61	pp	4	7½
44 (e)	45	52	53	55*	60	67	64	4½	79	89	..	44	48½
45 (w)	52	53	57	53*	54	65	59	5	73	77	..	25	30
46 (w)	67	60	63	67	72	81	83	5	87	96	..	29	34
47 (w)	60	64	61	60	61	64	72	5½	76	91	..	31	36½
48 (w)	53	56	57	53	56	61	62	4	76	85	..	32	36
65 (e)	49	54	53	49	54	49	54	4½	55	63	pp	14	18½
50 (w)	38	37	37	38	42	45	47	3	55	56	p	18	21
51 (e)	41	42	44	..	..	..	..	..	..	..	..	..	..
52 (w)	55	54	56	55	51	53	62	3½	60	74	pp	19	22½
67 (w)	47	55	57	57*	58	54	62	5	64	77	..	30	35
54 (w)	52	57	57	52	57	64	68	5	71	81	..	29	34
55 (w)	58	60	62	58	58	66	64	5	78	90	..	32	37
56 (e)	52	47	47	47†	53	60	55	5	69	77	..	25	30
57 (w)	61	62	61	61	63	70	66	5½	80	91	..	30	35½
58 (e)	46	50	58	46	49	54	59	4	67	77	..	31	35
59 (e)	55	60	56	55	57	65	59	6	76	86	..	31	37
60 (w)	44	43	45	44	51	54	59	4	62	70	pp	26	30
61 (w)	48	47	47	48	..	..	..	..	..	..	..	..	..
62 (w)	52	47	51	55*	52	57	58	4½	69	79	..	27	31½
63 (e)	66	72	67	66	71	78	74	7	92	103	..	37	44

w = wether; e = ewe; p = dosed for parasite 2/2/29; pp = dosed 2/2/29 and 10/1/29; * = increase; † = decrease.

Average total increase: Ewes, 27·7 lb.; wethers, 23·4 lb. Average weight of wool: Ewes, 4·8 lb.; wethers, 4·3 lb.

It will be noticed that after the fourth weighing only five sheep showed an increase, while one (No. 56) showed a decrease. At this time the paddock was halved and the sheep had a shift, which shows in the weights, only three being lower at the next weighing. Nos. 24, 25, and 43, all wethers, do not show satisfactory increases. No. 63 is now the heaviest sheep of that age in the experimental paddocks.

Table 2.—Weights of Sheep on Gypsum-dressed Paddock (First Group).

Number.	6/11/28.	26/11/28.	10/1/29.	11/2/29.	Wool (26/11/28).
68 (w) ..	61	66	69	80	4½
69 (w) ..	70	78	79	87	6
70 (e) ..	62	67	67	81	4½
71 (e) ..	64	71	72	84	7½
72 (e) ..	67	74	84	96	6
73 (e) ..	64	71	75	85	5½
74 (e) ..	73	83	86	96	8
75 (w) ..	67	75	85	98	5

Average increase in weight: Ewes, 22·4 lb.; wethers, 22·3 lb. Average weight of wool: Ewes, 6·3 lb.; wethers, 5·2 lb.

It will be seen that in no case was there a decrease in weight, though No. 70 did not increase in six weeks.

Table 3.—Weights of Sheep on Control Paddock (First Group).

Number.	6/11/28.	26/11/28.	10/1/29.	11/2/29.	Wool (26/11/28).
76 (e) ..	62	67	71	80	5½
77 (w) ..	74	80	84	88	4
78 (e) ..	53	58	59	64	5
79 (w) ..	71	72	82	89	5
80 (w) ..	66	70	76	85	4
81 (e) ..	55	58	48	47	4½*
82 (w) ..	67	71	78	89	6
97 (w) ..	70	76	83	91	5
84 (e) ..	64	70	74	82	5½
85 (w) ..	71	77	76	85	6

* Drenched 10/1/29 and 2/2/29.

Average gain in weight: Ewes, 9·75 lb.; wethers, 19·7 lb. Average weight of wool: Ewes, 5·1 lb.; wethers, 5·0 lb. (The apparent disparity in the respective gains of ewes and wethers is due to the loss of 8 lb. by one of the four ewes. Actually, with this one exception, the ewes did as well as the wethers.)

The sheep on the gypsum and control paddocks were wintered on turnips, and were of a better type than the sheep on the limed paddock, thus having a great advantage. All of this group of experiments are being conducted on one farm and the paddocks are adjacent to one another. Arrangements are being made to increase the size of the gypsum and control paddocks, so that the number of sheep on them may be increased and thus give more reliable results. The owner of the sheep has generously agreed to allow them to remain on the experimental areas for another year. This and the gypsum-dressed paddock will be doubled in area for next season's experiment.

It will be noted that the experiment on the limed paddock covered a period of ten months, whereas those on the control and gypsum paddocks had been in progress for only three months. These latter are therefore not strictly comparable with the limed paddock.

SECOND GROUP.

Another area was selected about three miles away from the first group, and 13 tons of ground limestone were spread on about 9 acres.

FIG. 1. HOGGETS AFTER A YEAR'S GRAZING ON LIMED PADDOCK (SOLE DRESSING) AT NAPENGA, MAIROA—SEEN IN PERFECT HEALTH.

FIG. 2. EWES AND LAMBS ON LIMED PADDOCK (SOLE DRESSING) AT MAIROA VILLAGE, AFTER A YEAR'S GRAZING.

The condition of these animals speaks for itself.

[*Photos by B. C. Aston.*

Ten ewes, from two-tooth up to six years old, having been specially selected as being unsuitable for breeding-purposes and not likely to survive, were put on this paddock. No. 18 was so weak that it was only with difficulty that she could walk to the pen for weighing. It was decided that no control would be necessary in this case, as the sheep were a class on their own, and that bringing them through the year would be a sufficiently severe test. It was also decided to keep

the ewes dry, but seven of them accidently got in lamb and lambed normally in due course. These lambs were numbered and weighed and will be placed on a limed paddock for further observation. The fact that the ewes gave such a good increase in weight and that the lambs did so well, as indicated by the tables, is looked on as quite a satisfactory result.

Table 4.—Weights of Ewes on Limed Paddock (Second Group).

Number.	10/5/28.	4/7/28.	23/8/28.	2/10/28.	2/11/28.	1/12/28.	Wool.	11/1/29.	12/2/29.	Age, in Years.
13 ..	71	87	94	90	90	95	5½	100	103	5
14 ..	78	83	86	96	101	103	5½	108	109	4
98 ..	78	85	93	109	98	100	5	99	100	3
16 ..	85	100	106	125	114	116	4½	116	118	6
17 ..	113	117	121	138	120	118	5	113	109	5
18* ..	61	68	82	83	88	94	5	99	102	3
19* ..	80	91	94	113	119	132	6	135	139	6
20 ..	91	103	96	93	92	91	5½	96	96	6
21* ..	55	57	61	72	78	81	6½	84	88	2
22* ..	66	75	81	99	113	86	6½	88	93	3
23 ..	54	67	72	93	84	84	4	92	98	2

* Dry ewe.

Table 5.—Weights of Lambs from Seven Ewes in Table 4 (Second Group).

Number.	Wool.	21/12/28.	11/1/29.	12/2/29.	No. of Dam.
1 (e) ..	1	52	56	69	16
2 (w) ..	1	48	53	65	23
3 (e) ..	4	71	69	78	20
4 (e) ..	3	67	62	70	13
5 (w) ..	1½	50	53	62	17
6 (e) ..	1	50	55	68	98
7 (e) ..	1½	48	47	54	14

Arrangements have been made to keep these lambs on a limed paddock, and they will be weighed and watched as part of the experiments. A further area of 5 acres has been limed, and will be included in the limed paddock for next season's experiment.

A further experiment on this farm was one in which 25 acres of country that had reverted to fern badly in parts was top-dressed with 5 cwt. of ground limestone and 2 cwt. of super per acre. The fern, where it was possible to do so, was similarly treated. The paddock was fenced and stocked with cattle and sheep, which had the run of a larger area as well. The stock worked the paddock well, and the fern is now (at the end of six months) practically all dead and the grass looking very healthy. On this farm last year approximately thirty wethers were sold fat, while this year 130 fat wethers have been sold at top price, most of them coming off the top-dressed paddock. It is hoped to have a weighing experiment on this paddock in the present season.

GENERAL.

A rain-gauge was installed locally during the year and the monthly records to the end of February were as follows :—

	Total Fall in Inches.	Number of Wet Days.
August	7·22	22
September	19·36	24
October	10·18	22
November	4·52	16
December	6·40	16
January	2·39	13
February	2·10	5

The carrying-out of these experiments has involved 700 weighings of sheep. In addition, 105 samples of pasture and seventy-four samples of wool have been collected and forwarded to the Agriculture Department's Chemical Laboratory at Wellington.

Experimental work in the administration of mineral supplementary rations by the pellet method has been commenced locally, and will be the subject of a later report.

WEEDS AND THEIR IDENTIFICATION.

APPLE OF PERU (*NICANDRA PHYSALOIDES*).

ESMOND ATKINSON, Department of Agriculture, Wellington.

APPLE OF PERU is not scheduled in the Noxious Weeds Act, nor is it a plant which is likely to be found in lists of bad weeds, as it is an annual with an unaggressive root-system. Where it is established, however, it is so conspicuous, and, furthermore, shows such curious points of likeness and of difference when compared with Cape gooseberry (*Physalis peruviana*), that it is just one of those plants about which questions are always being asked.

Cape gooseberry is very well known in New Zealand, but is really naturalized in only a few places; it is generally found as an "escape from cultivation"—the name given to a plant that can continue to exist and to reproduce itself near where it has been grown, but which spreads very slightly and is not capable of making itself at home as a unit of the vegetation. Apple of Peru is definitely naturalized, though only within certain narrow limits, being generally described as a weed of roadsides and waste places. From the practical farmer's point of view such a plant is not a "weed" at all, and now seems an appropriate time to emphasize again the primary object of these articles —to help those who are interested to find out the names of the many wild plants (introduced and native) that occur within settled areas, quite apart from their immediate importance as agricultural weeds.

There is no confusing these two closely related plants when they are in flower—the lavender-blue and white of *Nicandra* being different enough from the pale yellow and deep purple (almost black) of the

APPLE OF PERU (NICANDRA PHYSALOIDES).

(*a*) Leafy shoot with buds, a flower, and young fruit; (*b*) part of stem near base, with a ripe fruit. All natural size.

[*Drawing by Esmond Atkinson.*

other. The fruits are much alike, though, and the following key is given to show the technical differences :—

Calyx inflated after flowering—
Calyx 5-partite, cordate at base .. .. *Nicandra physaloides.*
Calyx shortly 5-lobed .. .. .. *Physalis peruviana.*

This may be translated to mean that the cover of the berry in the case of apple of Peru is made up of five separate lobes or divisions that extend backwards beyond where the stalk is joined on to them, so that when the whole fruit is seen from the side it has a heart-shaped or cordate appearance (see illustration). In Cape gooseberry the five lobes are joined together for most of their length (they spread a little at the tips), and they end where they meet the stalk and do not extend backwards to form a heart-shaped base. The juicy yellow berry of Cape gooseberry is replaced by a smaller dull-coloured dry one in the apple of Peru.

Nicandra physaloides is a strongly growing, smooth, and hairless annual, 3 ft. or 4 ft. high, a single plant occupying about 1 square yard of ground. In the illustration (*b*) is shown a bit of the lower part of the stem, which is nearly 1 in. thick in a big plant, variously angled and ribbed, and hollow in the middle. The shape and size of the leaves are shown at (*a*). They are green and smooth, and not velvety to the touch like those of Cape gooseberry. The drawing also shows the different stages of development of the bud, and an open flower. Because of the size and unusual colour of the flower apple of Peru has been grown in gardens, but the flowers only open a few at a time and in bright sunlight, so the plant has never become popular. The fruit need not be described in detail; another likeness to Cape gooseberry is in the covering of the berry becoming finally quite dry and straw-coloured.

Nicandra and *Physalis* belong to the big family *Solanaceae*, which includes the potato, tobacco, and tomato, and such plants as the various kinds of deadly nightshade, &c., so well known as weeds. Apple of Peru is a native of South America, and was first recorded here early in this century. It is now found in many parts of the North Island, and as far south as Canterbury in the South Island.

CO-OPERATION IN CREAM COLLECTION.

A SUBJECT worthy of more consideration is the collection of cream in those districts where home separation is in existence, and where more than one dairy company is operating over the same area. The question of quality as well as of transport costs is involved. There would appear to be room for a number of our companies in certain districts forming a co-operative concern of their own for the transport of the cream within their territory, or conjointly making a contract for the transport of such cream. This should reduce costs, and be in the interests of larger pay-out to the suppliers. It should also have a beneficial effect on quality in some districts by way of making more frequent deliveries possible. It seems rather short-sighted policy for dairy companies to work independently in this respect when combined action would be to the monetary advantage of all concerned. It might also be good business for some companies to reduce the territory from which they seek to draw their supplies, and concentrate effort on reduced collection costs. More dairying development near the factory and better quality should be possible through attention to these matters.—*Dairy Division.*

SHELTER-BELTS FOR THE FARM.

(Extracts from State Forest Service Circular No. 25.)

EFFECT OF SHELTER-BELT UPON AIR-CURRENTS.

A SUMMARY of statistics available from experiments carried out in various countries to ascertain the efficiency of shelter-belts in subduing the velocity of wind and preventing the damage to crops shows that a shelter-belt 66 ft. in height will afford protection for a distance of 5 chains (or five times its height), and partial protection for a distance of 15 chains (fifteen times the height); even then the wind-current will not have regained its initial velocity. On the windward side of the "break" there is also a diminution of force for a considerable distance back owing to the disruption of the air-current caused by the rebound and uplift of the lower strata of air. (Diagram 1.)

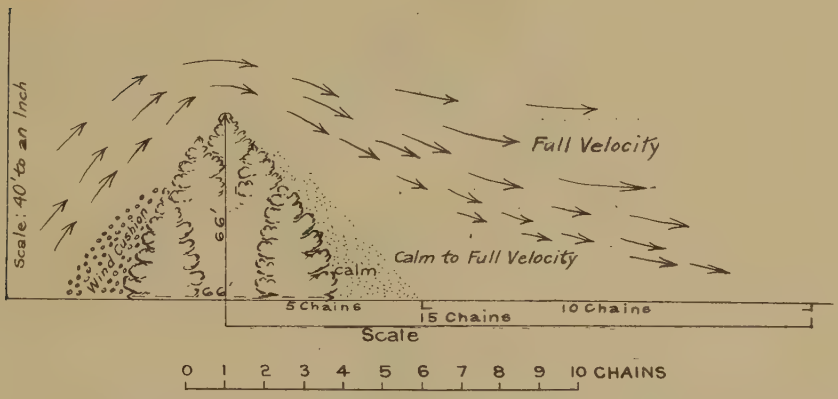


DIAGRAM 1.—EFFECT OF SHELTER-BELT UPON AIR-CURRENTS.

ASPECT AND RESULTANT SHADE FROM SHELTER-BELTS.

The direction of shelter-belts should, if possible, be north and south, so that a minimum of shade will be incurred, and, in addition, the two most troublesome winds north-west and south-west are diverted from the crop. In Diagram 2 the cone represents a series of shelter-belts from 30 ft. to 100 ft. in height, running north and south, the season of the year being midwinter. As an example of how to read this diagram, take a shelter-belt of trees 60 ft. high; it is found that the eastern paddock will be in full sun from sunrise until 12.58 p.m. and the western paddock from 11.20 a.m. until sunset. This demonstrates clearly that no part of either paddock is seriously affected by shade.

Diagram 3 shows a five-row belt of uniform height, the shadows of which are thrown 20 ft. farther out than is the case when the species are graded according to height. This is an additional advantage secured by the shelter-belt with a "conical outline."

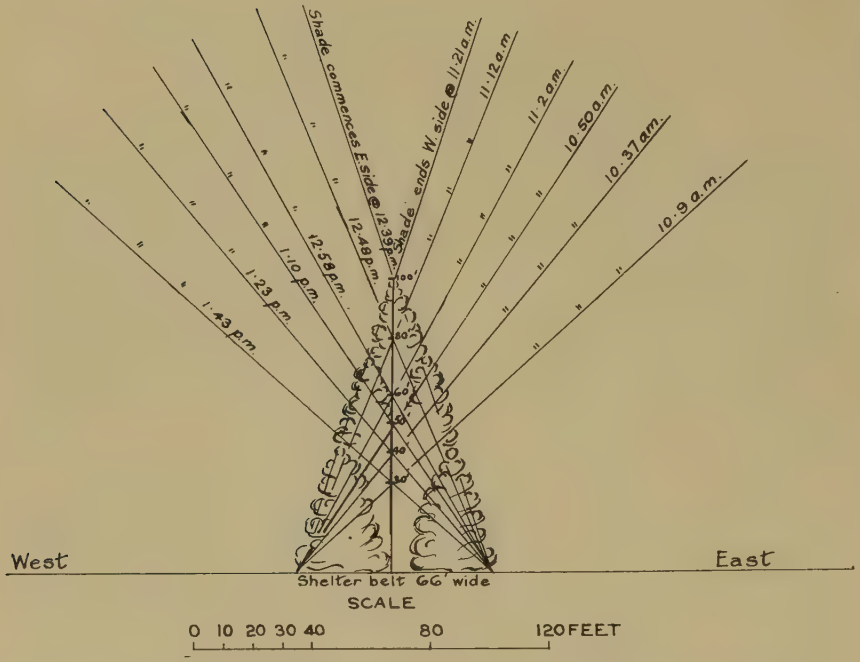


DIAGRAM 2.—CROSS-SECTION : SHELTER-BELT RUNNING NORTH AND SOUTH.
(Midwinter in Canterbury, Lat. 43½° S.)

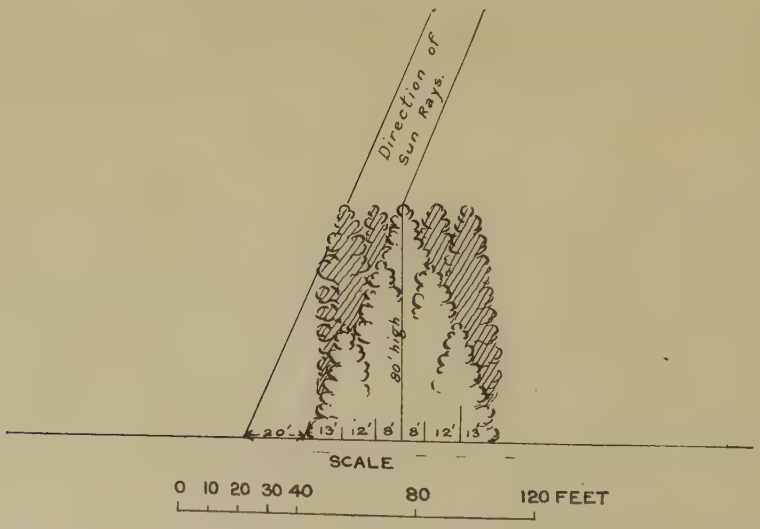


DIAGRAM 3.—CROSS-SECTION OF SHELTER, SHOWING ADVANTAGE OF CONICAL OUTLINE.

A shelter-belt running east and west is of comparatively little practical value, and does actual harm by the long shadows cast in winter. Diagram 4 shows a section of a belt running east and west, and illustrates the length of shadows thrown at the latitudes of Auckland, Canterbury, and Southland. For example, even in North Auckland the shade cast by an 80 ft. belt will extend 136 ft. Furthermore, east-and-west shelter-belts are no protection against the north-west and south-west winds.

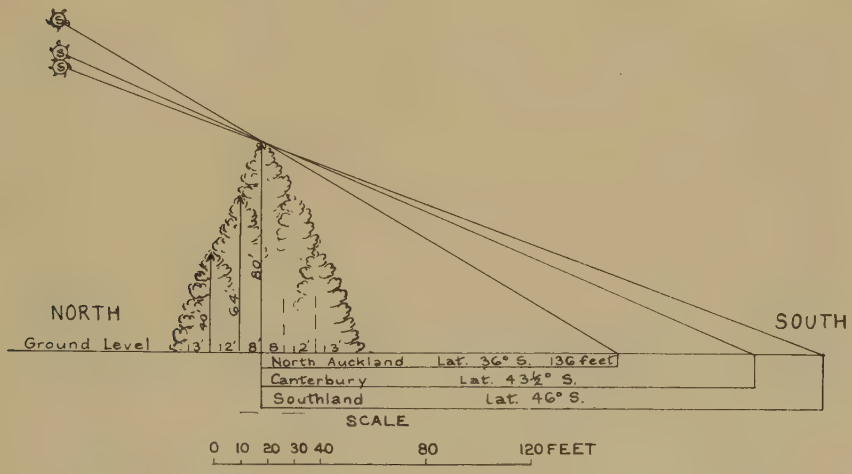


DIAGRAM 4.—SHADE CAST BY SHELTER-BELT RUNNING EAST AND WEST.
(Midday sun, midwinter.)

THE SHEEP LEG-LOUSE.

A SPECIES of louse on sheep which is not frequently seen, and on account of this is often not recognized by farmers, is one affecting the hairy portion of the leg and known technically as *Hæmatopinus pedalis*. The parasite infests both the fore and hind limbs, but more frequently is seen on the hind legs. It is a blood-sucker, and lays a large number of eggs which remain attached to the hair, giving the affected part a distinct brown appearance. The parasite first made its appearance, so far as is known, in the Banks Peninsula district. Since then it has appeared in various parts of the North Island, also in the Nelson District. In a case which came under notice last year the wool of a ram's scrotum was found to be densely infested, while the scrotum itself was considerably enlarged and hardened.

The leg-louse can be readily detected at shearing or crutching time. Ordinary dipping methods are effectual in dealing with the vermin, and as clean sheep may become infested by contact with affected animals immediate precautions should be taken to safeguard the flock directly its presence has been detected.

—*Live-stock Division.*

SEASONAL NOTES.

THE FARM.

ROTATIONAL GRAZING ON DAIRY-FARMS.

MAY marks the end of the main milking season, and now is a good time to make plans for next season's work. Many farmers are at present turning their attention to schemes of intensive grass-farming and the adoption of rotational grazing practices. The general principles underlying the practice of rotational grazing are now fairly well known. Briefly the system consists in the close subdivision of the grassland, regulated stocking, and heavy and complete manuring. Grass is treated as a crop, the pasture being allowed to reach a length of 3 in. to 5 in., quickly grazed down, and then spelled till the next crop of young grass is ready.

It is not possible at the present time to give any very definite information outlining a complete scheme for rotational grazing, for the experimental work conducted by the Fields Division this season has rather emphasized difficulties to be overcome than provided a system to be widely adopted. A certain amount of data, however, has been already collected bearing on the size of subdivisions and the intensive use of fertilizers that is of interest to farmers, and further notes will be published as the results of the season's work become available.

The first important point to be decided when adopting the system is the plan of subdivision and the size of the fields. Wherever possible the farm should be subdivided on the plan of a central race upon which all fields open. The race should not be narrow, as cows going to and from the milking-shed churn up a narrow race badly during wet weather. A width of 1 to 1½ chains is much more satisfactory than a race ½ chain wide. A wide race can be grazed and managed as an ordinary field. In most cases, however, there is no necessity to reorganize the whole internal fencing of the farm, and the subdivision of existing fields is all that is necessary. The size of the fields is determined by the rate of stocking, and it appears that the fields used for rotational grazing should be stocked at the rate of twelve to fifteen cows per acre at short intervals. A good even grass-growth of 3 in. to 4 in. in height will give two grazing-days of twenty-four hours each for twelve to fifteen cows per acre; for herds of twenty-two to twenty-five cows fields 2 acres, and for herds of thirty-five to thirty-eight cows 3-acre fields are satisfactory. Experimental work this season has shown that when stocking at the above rate the subdivision of 6-acre fields into two 3-acre fields meant the gain of a day's grazing. Before subdivision 6-acre fields were giving three days' grazing for thirty-seven cows, and when subdivided each 3-acre field gave two days' grazing for the herd. It is best to commence a scheme of rotational grazing gradually, making four or five small fields for a start, and treating the pasture on these fields as well as possible. It is unwise to enter on an extensive

scheme of rotational grazing until experience has been gained of the proper management of grassland under the intensive system of grass-farming. Also the practical difficulty of providing a continuous supply of feed, owing to the variation in the recovery period of pastures at different periods of the year, has not been completely solved at the present time. Some large fields which contain some rank feed are a good standby for grazing the herd during short droughty periods in the late spring and summer. This difficulty will probably be got over, but whether the feed thrown by the rotationally grazed fields during short dry spells—which may occur at any time in the spring, summer, and autumn—should be supplemented by partially rank growth on some reserve fields, by rank grass-growth and concentrates, by grass ensilage, or grass ensilage and concentrates, can only be solved by further experimental work.

One of the most marked features of the current experimental work on rotational grazing is the very high per-acre production of butterfat from rotationally grazed fields. During the first half of this season such fields have produced 150 lb. to 200 lb. of butterfat per acre, and this is far higher than the average production from the whole farm will be for the season. A considerable amount of experimental work, however, will have to be performed before a suitable grazing and supplementary feeding technique is evolved to enable dairy cows to convert all the spring, summer, and autumn production of grass (except that required for hay and ensilage for supplementary feeding) into butterfat.

With regard to manuring of the rotationally grazed fields, this season's experimental work has so far shown that late winter applications of nitrogen to heavily phosphated grassland have given appreciable increases in the early spring production of grass. The economics of these late winter applications of nitrogen are now being studied, and should the practice prove payable it will provide a means whereby the dairy-farmer can supply young protein-rich grass for early-calving cows.

TILLAGE OPERATIONS.

Teams will be busy during May and June sowing autumn and winter cereals. During any periods when the weather is not suitable for sowing or cultivating, and yet the soil not too wet to plough, a start should be made on turning over any vacant land intended for winter fallowing. In the sub-humid, arable farming districts of the South Island summer-sown root and forage crops usually follow a cereal, and the stubble land should be ploughed in the late autumn or early winter, and left in the unbroken furrow-slices, so that the weathering agencies may have free play in breaking up clods, and in order to allow the winter rains to quickly pass through the top soil and enter the subsoil instead of running off the surface.

Root crops require enormous quantities of water; a 30-ton crop of mangolds, for instance, consumes about 1,500 tons. An inch of rain amounts to 100 tons per acre, so that at the yield stated 15 in. of rain would be required for the crop. The rainfall over a

large part of the arable farming districts of Canterbury is about 25 in., and the normal rainfall from October to April is 14 in., which is insufficient for the crop, as only about one-third of the summer rains percolate through the soil, the rest being lost by evaporation. The root crops must thus draw upon the reserves of water held in the soil and subsoil. The months during which a large proportion of the rainfall may be stored in the subsoil are May to September, so that late autumn and early winter ploughing is essential for the production of good root crops.

WINTER FEEDING OF YOUNG DAIRY CATTLE.

The first winter is a critical period in the life of young dairy cattle, and their subsequent development depends very largely on the feeding during this period. Calves should be the first stock on dairy-farms to be given a ration of hay in the early winter. It is essential to get them used to hay and root feeding before the grass-growth seriously declines, because it is usually some time before calves will eat much hay, and if its feeding is left too late the animals will often lose condition which they will not pick up again. Besides adequate food, the calves should get an ample supply of pure water; dirty drinking-holes in drains are liable to lead to the young animals becoming affected with internal parasites.

—P. W. Smallfield, Fields Superintendent, Auckland.

THE ORCHARD.

LATE HARVESTING.

THE work of harvesting the fruit crop is now nearing completion, Dougherty being the main variety still to be dealt with. Most of the fruit intended for cool-store, with the exception of that variety, should be in store by the end of April. Coloured varieties of apples are frequently in demand late in the year, and to store a small quantity of well-coloured Dougherty is sometimes advisable. These should be in store by the middle of May. Small Sturmers and Sturmers from the lower part of the tree, left to swell or to mature after the main pickings have been made, should not be allowed to remain on the trees too long, as frequently they become badly disfigured by the development of the characteristic small red spots caused by the fungus disease known as apple-spot.

THE AUTUMN CLEAN-UP.

The time immediately following the completion of the fruit harvest is opportune for a general clean-up of the orchard and packing-shed prior to beginning winter operations. Cases used for picking may be repaired and stacked away in readiness for the next season. Props gathered from the orchard may also be stacked, and if taken care of in this way they will serve for several seasons, even if they be of soft wood. Diseased and rotting fruit about the

packing-shed should be buried deeply, and the mummified remains of stone-fruit affected with brown-rot which may have been left on the ground during the rush of harvesting should also be gathered and destroyed or buried deeply. Trees affected with silver-leaf should be destroyed while they are easily distinguishable from healthy trees. Once the foliage is off they may be easily overlooked. Similarly, fireblight infections—some of which may hold over to spread the disease in the following spring—should be searched for and cut out now while they are more readily located. A premature autumning of the leaves on portions of pear-trees should be investigated, as this often leads to the discovery of a fireblight canker lower down the limb or branch.

DRAINAGE.

Open drains require cleaning out and putting in order before the winter; and outlets to tile drains clearing to allow of a free flow. Provision should be made for diverting surface water into open drains, or leading it off any portion of the orchard where such surface water is likely to gather. New drains to tap wet parts, especially in heavy retentive soils, should be opened up and tiles laid. It is not an economy to neglect drainage and find later that trees which should be coming into a productive state suddenly go into a decline through sour-sap caused by lack of drainage. Underground water such as springs or seepage may be disposed of by pipes, placing them at such a depth as to prevent the water rising above a certain level—say, 3 ft. from the surface. Rainfall on a retentive subsoil may also be disposed of by pipes, but ready access from the surface to the pipes is necessary. Pipes should therefore be covered by clean rubble or scrub, and subsoil dug out should not be placed back, as it would tend to seal the drain. Surface-water drains should be laid well below the loose surface-soil, and all drains should have a slight fall in every portion, otherwise silting up will occur in hollows.

CULTIVATION AND MANURING.

It is advisable, especially on heavy land, to turn the soil over now, so as to secure the full benefit of winter rains and frost for bringing it into a good tilth early in the summer. The orchard should be ploughed with the slope to facilitate surface drainage, ploughing up to the trees, and leaving an open furrow in the middle of the lands. Land intended for orchard extension should also be deeply ploughed now to ensure the ground being in good order for planting in the spring.

Most soils require periodical limings, and a dressing of up to 1 ton per acre may be applied now. Inorganic manures such as blood-and-bone may also be applied now, but the use of the quicker-acting fertilizers may best be deferred till nearer the spring movement.

NEW PLANTINGS AND WINDBREAKS.

Preparation for new plantings should be put in hand early. Already a decision should have been made as to varieties, and arrangements for a supply of trees. For commercial plantings the

choice of suitable varieties is limited, particularly with apples and pears. Varieties chosen should be chiefly those most suitable for export, as these are also suitable for local markets. However, the list may be supplemented with an early cooking and an early dessert variety for local requirements. Whether it is pip-fruit or stone-fruit being planted, or both, care should be taken to secure a succession, in order that the work of harvesting may be spread over the whole season.

Land should be put into thoroughly good condition before planting, and consideration given to shelter-belts, drainage, and general lay-out. The distance for planting is an important consideration, as hitherto the space between trees on rich land has generally been quite inadequate, especially for pears and stone-fruit. On some of the better class of land used for orchard purposes 25 ft. will prove a more suitable distance between trees for this class of fruit. It is inadvisable to plant large blocks of one variety without breaks. Plantings should therefore be so arranged as to limit the number of rows to five or six. Ample space should be left between fences or hedges and the nearest rows of trees in order to allow of easy turning with horses. Most planting is done in the spring as soon as the land is in a suitable condition for working. However, autumn planting may be resorted to in dry warm soils and if matured trees are available. This work may be done during May.

Windbreaks are a necessity in almost every locality, and should be planted as early as the setting-out of a new orchard. Shelter-belts to existing orchards require frequent topping, as to have an orchard too enclosed renders disease-control more difficult.

SPRAYING OF STONE-FRUIT.

An autumn application to stone-fruit trees of a bordeaux spray, 6–5–50, may be made for the purpose of better controlling such diseases as leaf-curl and die-back. Such an application has proved beneficial on some of the varieties of peaches notoriously prone to leaf-curl.

—*N. J. Adamson, Orchard Instructor, Hastings.*

Citrus-culture.

New Plantings and Extensions.—Where it is intended to plant during the coming season, preparation of the land right away is advisable. Being assured that the locality and soil is suitable, the next consideration is shelter adequate to the locality. If such has not been provided, early May planting of a suitable hedge or trees should be undertaken. When put in early such plants make better establishment and more luxuriant growth during the following spring. There are few situations so favourable as to allow citrus-trees to be planted the same year as the shelter, and the advisability of cropping the land for a season and planting later must be considered.

If the proposed site does not possess a naturally free subsoil underdrains will be necessary, and these are best put in as the land

is being prepared. There is no hard-and-fast rule as to what distance apart drains should be laid; this will depend on the retentive nature of the soil. Though the larger sizes of tiles are more expensive they are to be preferred to those of small diameter, because not only do they provide a clearer outlet for surplus water, but the extra air-cavity has an extended pull under the land.

On most land areas there will be found surface depressions which are better filled prior to tree-planting, otherwise the hollows will be a constant lodgment area for water, to the detriment of tree-establishment.

In the case of established citrus-groves all drains should be examined and cleared, and the surface-soil regulated in the working to allow easy get-away for surplus water.

Disease-control.—In anticipation of citrus brown-rot during the wet period it is as well to take preventive measures now. All branches which sweep the ground or hang within 1 ft. of the soil should be cut away, as it is on these that the spores first find lodgment when splashed up from the soil. Precautionary measures are of a threefold character: (1) Sterilization of the soil where the spores reside; this is usually done with sulphate of iron—2 lb. per tree—worked into the surface-soil. (2) Pruning away lower branches of the trees, so that spores missed by sterilization are not so readily lodged on the tree by rain-splashes from the soil. (3) An application of bordeaux, 4–4–40, to the trees in early winter, which acts as a preventive of germination to such spores as chance to alight on the covered parts.

In certain localities where brown-rot is not prevalent part of this treatment may suffice, but it is well to be prepared in the entirety, as each of the three operations is good practice for other reasons. No. 1 improves the general tone of the tree; No. 2 allows better cultivation; and No. 3 is good against verrucosis and grey-scab.

—W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

TUBERCULOSIS.

At this period of the year it is well to keep a sharp lookout for any bird showing signs of being affected with tuberculosis, as at no time is it more prevalent than just before or just after the moulting-period. The disease chiefly affects adult stock. It is caused by a micro-organism known as tubercle bacillus, and the chief source of infection is through the digestive tract. The droppings of the affected bird contain enormous numbers of the deadly germs, and it will therefore be readily understood that the feed, &c., may easily become contaminated and the disease spread at an alarming rate. Usually tuberculosis attacks flocks where the surrounding conditions are insanitary, and where the birds are poorly fed and do not possess a vigorous constitution. The disease is very contagious, and if it once makes its appearance in a flock there is no telling when it may be stamped out.

Tuberculosis is undoubtedly the worst disease the poultry-keeper has to fear in this country, chiefly because in its early stages there are no definite signs by which it can be detected. As the disease develops many signs manifest themselves which are apparent to the person with experience. A gradual loss in weight and an apparent shrinkage of the body is perhaps the first and plainest sign of the disease. Then the breast-bone stands out sharply and the neck is devoid of flesh. Later the comb becomes dark and the bird gets dull and listless, and is not inclined to mix with other members of the flock. Sometimes at this stage diarrhœa accompanies the disease, and there is lameness in one leg. From then on the disease rapidly develops, the bird becomes more and more emaciated, and finally dies. When a diseased bird is opened up the liver and spleen are usually found to be spotted with tubercular nodules. Sometimes the terms "spotted liver" and "going light" have been used to designate the condition of a bird whose liver presents this appearance. Usually, however, it is tuberculosis and nothing else.

For this disease there is absolutely no cure. The only way to fight it is to prevent it, and the first requirement in this direction is to breed birds with the necessary constitutional vigour to resist the infection should they come into contact with it. Any bird showing similar symptoms to those described above should be killed and opened up, and if the disease is present the body should be burnt without delay. Drastic methods of suppression are most necessary. The houses where the affected birds have been kept should be thoroughly cleaned and all sources of infection removed. This should be followed by a good spraying of strong sheep-dip or similar preparation. Until the disease is thoroughly stamped out all the droppings should be carefully gathered up and burnt or deeply buried with lime. When possible the quarters where infected birds are found should be given a rest, and the runs turned up, heavily limed, and sown down. It may be mentioned that tuberculosis and other diseases which affect poultry can always be better controlled when the floor of the house is made of concrete.

It must be again emphasized that prevention is the only way of combating tuberculosis. It is therefore imperative that the environments should at all times be as sanitary as possible, and the birds strengthened and invigorated by good feeding and sensible management generally.

CULLING THE WRONG BIRDS.

While watching various lines of poultry being sold at an auction-mart recently, an owner of a crate of White Leghorn hens, which were alleged to be his culls, sought my opinion regarding them. As they were generally good specimens of their breed, late moulters, and possessed striking signs of having produced heavily, I at once expressed an opinion that with the exception of an odd bird or two the line would make good breeding-specimens for any one requiring such birds. This surprised the owner, who went on to say that he weeded out these particular birds because they were the roughest looking in the flock, and as they were more or less devoid of feathers on the head he was afraid that this indicated a

form of disease. It is to be feared that this is only one case in many where the future profit-makers and most desirable breeding-specimens have been discarded, while the drone types have been retained on the plant. It has been proved over and over again that late autumn is the best time for culling a flock, and that the heaviest layers are the thinnest at this period and present the most worn and shabby appearance, while the heaviest and best-looking birds—those that have moulted and renewed their feathers—are the drones.

With regard to the question of the head going bare, it is safe to say that, particularly with White Leghorns, it is only the best layers in the flock which become affected in this way, and for what reason it is difficult to say. This so-called trouble need cause no anxiety to the poultry-keeper, as the bare places will feather over after the moulting-period.

DESTROYING INSECT PESTS.

In the *Journal* for last December some particulars were published relative to an experiment conducted at the Wallaceville Poultry-station on ridding fowls of insect pests by applying Black Leaf 40 to the perches. Since the result of this experiment was published I have received numerous inquiries to the following effect: What is Black Leaf 40? Where is it procurable? To what extent should it be diluted with water, and is the treatment likely to injure the birds? Some of the inquiries may well be answered here.

Black Leaf 40 is a by-product of tobacco. It is sold in liquid form in various-sized tins by vendors of orchard sprays and others. Providing this material is applied to the perches undiluted and as advised in the *Journal* referred to, it will undoubtedly have the effect of destroying any vermin that might be on the fowls, and will in no way injure the latter or lower the egg-yield. One correspondent advised me that he diluted the Black Leaf 40 with water before applying it to the perches, and that it by no means had the desired effect of destroying the vermin. He now informs me that after using the material in its undiluted form he could not find a living louse on any bird in the flock. Here it may be mentioned that the nicotine preparation is too costly to waste. All that is required is a thin line of the liquid poured on to the perch just before the birds go to roost. If there is much dust on the perch the liquid is apt to run off and become wasted, and to prevent this it is a good plan to first rub the perches over with a damp cloth. If this is done the liquid can be more easily applied to the centre of the perch and the risk of wastage will be reduced to a minimum.

As a result of observations already made in connection with a further experiment that is being carried out with Black Leaf 40, I have every reason to believe that in addition to destroying those kinds of insect pests which continuously live on the bodies of fowls, it will also tend to a great extent to keep the red-mite at bay, and also the minute parasite which is responsible for the common trouble known as scaly leg in fowls. While the great value of the

Black Leaf 40 treatment for rapidly destroying certain kinds of parasitic life that live on poultry has been amply demonstrated, it should not be taken for granted that this is the one and only correct way of dealing with these enemies. As with most troubles affecting poultry, the only really feasible way of fighting vermin is to prevent them from making their appearance. The maintaining of the birds in good health and vigour by sound and liberal feeding, together with strict attention to cleanliness and provision of good dusting-places, are among the essentials for keeping parasitic life at bay. —*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

MANAGEMENT OF SUPERS.

As recommended last month, the removal of the supers should go on steadily as the bees form their winter clusters. In the case of very strong colonies it will often be found difficult, if not impossible, to confine the bees to one story without seriously diminishing winter stores and undue crowding. In these cases it is best to leave the supers on till spring.

The best place for winter stores is in the hive. However careful the beekeeper may be in replenishing stores, if the honey is removed from the hives he still runs the risk of allowing the bees to starve out if the honey is not within their reach at all times during the cold weather. There are very few districts in New Zealand where brood-rearing absolutely ceases during the winter, especially when the hives are well sheltered, and the bees require food at all times and seasons. On no account should the bees be allowed to winter in more than two stories. In many cases they will be showing a tendency just now to go as high as they can get in the hives, and where this happens it will usually be found that the combs in the bottom story are deserted and dry. A rapid examination will soon show whether this state of affairs obtains, and, if so, the bottom story should be removed, leaving the cluster undisturbed.

Where queen-excluders have been left on the hives they should be removed, because it sometimes happens that the bees will go through the excluders to the stores above, leaving the queen to perish below. There is always a tendency for the cluster to move to the warmer part of the hive, and an excluder will not act as a bar if the bees are dissatisfied with the lower story.

MATS FOR WINTERING.

To ensure that the bees are kept warm through the cold weather it is absolutely necessary that the frames should be well covered with good mats. Three or four are by no means too many to provide for each hive. Ordinary corn-sacks cut into pieces the size of a zinc queen-excluder answer the purpose admirably, and are

very durable. Avoid using calico mats, as these are next to useless for wintering purposes. It is essential that the mats should fit exactly over the frames; if too small they admit draughts, and if too large the edges will protrude beyond the hive-covers, and in wet weather these will absorb sufficient water to cause the mats to become damp and unhealthy and the combs mouldy.

CLEARING WEEDS.

Weeds and long grass should be kept down. A good clearing round the hives in the autumn will suffice until the spring, and will add materially to the comfort of the bees and the well-being of the hives during the winter months. Not only should the entrances be cleared, but the ground all round the hives should be similarly treated and the weeds raked up and destroyed.

CARE OF HIVES.

At no other season is the welfare of the hives of such importance as during the next few months. Every hive should be raised from the ground the height of one brick, and if the situation is damp or lowlying it is a good plan to raise the hives still more. This will tend to keep them free from slaters (wood-lice) and other insects, and will afford less harbour for mice, as well as ensuring that the hives have a free current of air beneath the bottom-boards, and will thus be more likely to keep dry. Never rest the bottom-boards on the ground, or they will rot in a very short time and become mouldy and evil-smelling.

Before winter weather sets in it is a good plan to give a coat of paint wherever it is needed, at the same time stopping up all cracks in the super. Cracks afford ventilation during the summer months, but they are hardly to be advocated on that account, because it will usually be found that towards the end of the honey-flow the bees will use up much valuable time in gathering propolis to stop up the cracks in view of the approach of winter. The hives should be slightly canted forward, so that any rain which falls on them will drain off the alighting-board.

LEAKY HIVE-COVERS.

Apart from disease, there is no worse feature in any apiary than leaky roofs. A cover which allows moisture to trickle through is a constant menace to the colony it appears to shelter. Not only will the mats immediately beneath it become sodden and mouldy, but the cluster of bees in the hive stands in danger of extermination when frost occurs. There will then be pollution unspeakable on the bottom-board, where the intruding moisture mixing with dead bees and waste pollen forms a rotten fermenting mass, with a stench which the order-loving bees must find more obnoxious than does their owner.

There is no excuse for leaky covers. In the autumn the apiarist should examine them for any doubtful spots, and should either cover them with zinc, ruberoid, or some other waterproof material; or, if economy must be practised, he should cover with

cheesecloth, applying to the roof first a coat of paint, then the cheesecloth, and then another coat of paint. This makes an effective waterproofing, and one which anybody can apply.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

THE TOBACCO CROP.

THOSE who are curing and storing tobacco-leaf should carefully consider the following points:—

While the curing-barns require ample ventilation, especially for drying off the leaf as soon as it is cured, a cold draught, particularly in humid weather, will do much harm, spoiling the colour and setting up fungus growth. This means that the ventilators and blinds require proper adjustment as the weather changes and curing proceeds. The importance of this attention increases as late autumn approaches, but it should at all times be carefully watched.

Buildings for curing leaf must be weatherproof. If the roof leaks and drips occur occasionally, moulds will become established and rapidly spread, making endless difficulties.

Waste leaf and stalks littered about the floor and round the building will decay and infect valuable stocks. Cured tobacco-leaf is very sensitive to dirty and musty flavours, which quickly displace the fine natural aroma if the leaf is exposed to contamination.

When charging the barn all plants on the sticks must be evenly spaced. Eight pairs of plants may be slung on a stick 4 ft. 6 in. in length, and these sticks should all be 1 ft. apart on the tier poles, also the tips of the plants above must not overlap the butts of the plants on the tier below. Neglect of this precaution delays curing and is the frequent cause of "pole burn." These are dark spots on the leaf without elasticity and very tender—in fact, the affected area has rotted. Proper spacing throughout the barn enables adequate ventilation to be given to all parts at the right time, and so enables one to control the conditions necessary for a proper cure.

Leaves or plants harvested with dew or rain upon them easily bruise, become bedraggled, and never develop a proper texture. These are only a few of the evils which arise from this practice, which is quite incompatible with good results.

Shed-room at harvest-time is usually tested to the utmost, and systematic shed management must be carefully worked out, so as to use the space to best advantage. The upper tiers, probably because they are more inaccessible, are sometimes comparatively little used, while the lower tiers are congested with leaf at different stages of development. A suitable system must make use of all the available space, and in such a way that the development will proceed systematically from top to bottom or from end to end. This not only saves labour by facilitating handling, but leaf at different stages can be given its necessary treatment.

Most important of all is the fact that bright well-cured leaf that is stripped and tied up into hands cannot be left about without rapidly deteriorating. As before stated, leaf at this stage is very sensitive, and quickly loses aroma, texture, and colour, as well as acquiring foreign odours, unless it is properly stored. Leaf is best bulked in a good clean ceiled room that is warm and dry, and occasionally ventilated in fine weather. It may be stacked, with the butts of the hands outward, about 4 ft. to 5 ft. wide, and the same height, with a few boards and weights on top to compress it, and keep the air out. This should be done when the blade of the leaf is in soft condition. The bulk should be examined occasionally for the first week or so, to see that it does not heat or any deleterious development take place. If that happens it must be aired or reconditioned before restacking.

SMALL-FRUITS.

Organic manures that have been accumulated and cured during summer and autumn should now be spread between the rows of bush fruits and lightly ploughed in. These plants crop heavily and require generous treatment. The tomato-plant is a more delicate feeder, and on land that is to be planted with that crop next season a green cover-crop, such as oats and horse-beans, sown now is often very suitable.

Where new breaks of bush fruits or strawberries are to be planted the work should be done now as soon as possible, in fine weather, and only on land that has been thoroughly prepared.

THE CHINESE GOOSEBERRY.

Regarding that handsome vine the Chinese gooseberry (*Actinidia chinensis*) a Californian correspondent, writing to a contemporary publication, states: "The several notes that have appeared recently on this fine vine, and the fact that one correspondent has the fruiting form, prompts the remark that if this is also in cultivation it is the easiest possible matter to graft it on the male form and have both. We have found this *Actinidia* the easiest subject to graft; scions will unite overnight, as may be proved by using two branches, grafting them, and placing them in a warm, moist house, and the next day new cambium will have formed. *Actinidia chinensis* is hard to root from cuttings. It may be layered easily; with us it will climb to the top of the highest trees. The fruits are very palatable, easily peeled after scalding, and in China they are making an excellent 'gooseberry' jam of it. Seeds when available are germinated readily, and the seedlings when large enough are easily grafted with both forms, if desired. There is a suspicion here that there are plants that possess the ability to fruit when planted alone. We have seen this occur, and can only reason that some individuals possess both reproductive organs."

The commercial possibilities of Chinese gooseberry remain to be proved, but it appears to be hardier than was at first expected, and is doing well in many places in this country. Being handsome and vigorous, the plant also has a considerable ornamental value.

THE MARKET-GARDEN.

In this section the most important seasonal work consists of planting out the crop of spring cabbage and cauliflower on a piece of land that is warm and well prepared; completing the earthing-up of celery; and cutting and clearing away the asparagus growth before the seeds fall. This last crop will benefit generally from a good dressing of well-cured organic manure turned in, as also will the rhubarb crop.

Seed-beds of lettuce are generally sown now in frames or in glasshouses for early spring planting. The "rust" disease that often attacks the plants will be avoided if they are sown thinly and given plenty of air at all times. However, the plants must be kept dry to avoid this trouble. In the frames this may be done by giving plenty of side ventilation.

Harvesting the winter crop of savoys has already commenced, and will be followed by crops of celery, leeks, and broccoli. Crops of potatoes and onions now in store will require attention until they are well dried off. Potato-seed for another season should now be obtained and given careful storage.

Vacant ground should not be neglected; grassland should be carefully broken in; and fallows sown down in a green crop, or well dressed with organic manures and turned over in preparation for spring planting and sowing. This early preparation is most important; it destroys noxious insects in the soil as well as harmful weeds, and thus gives a good and early start to the crops which follow. Successful cropping depends very largely on these measures.

SHELTER-TREES AND HEDGES.

Another important factor in the successful management of orchards and gardens is well-placed and carefully tended shelter-belts. These should now be topped and thinned or trimmed, as may be required, and the litter piled and burnt. Too much attention cannot be given to this important matter at present. Where new plantings of this kind have to be made, the land should be cleaned and kept cultivated until the plants are well established.

—W. C. Hyde, Horticulturist, Wellington.

Appreciation of the New Zealand Dairy-produce Grading System.—In a recent report to the Director of the Dairy Division, Mr. W. Wright, Inspector in Britain, remarks: "It is very pleasing to be able to pass on to you the compliment paid to the grading staff of New Zealand by representatives of two of the large Liverpool provision houses yesterday. In the course of conversation the statement was made by one firm that for two years there had been no examinations made of New Zealand butter handled by them, nor had any complaints been received from buyers. It was also admitted by the other firm that no examinations of New Zealand butter had been made in their warehouse during the current season. It was stated that this confidence in the quality as indicated by the grade marks is the result of the efficient work of the graders in New Zealand, testifying to the skill and good judgment of quality by the staff. This, I think you will agree, is a great compliment, unsolicited in any shape or form, and illustrates the beneficial results of an efficient grading policy."

TESTING OF PUREBRED DAIRY COWS.

CLOSING C.O.R. LIST FOR 1928.

Dairy Division.

THE appended list, comprising eighty-seven names, completes the publication of individual records for certificates granted in 1928. It will be noticed that, despite the fact that two-year-olds comprise a large proportion of the list, no less than thirty-five out of the total of eighty-seven cows have been credited with yields in excess of 500 lb. butterfat.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS.						
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Someview Dairy Girl	A. E. Phillips, Maunu ..	1 325	240·5	365	10,787·0	580·83
Glencoe Buttermaid	A. E. Phillips, Maunu ..	2 57	246·2	365	9,731·2	577·02
Jersey Brae Sunset ..	T. Church, Te Rapa ..	1 351	240·5	365	8,997·9	516·48
Woodstock Sue ..	A. Banks and Son, Kiwitea	2 10	241·5	365	8,548·6	502·62
Uruti Pride ..	W. Oxenham, Uruti ..	1 306	240·5	365	9,176·4	484·28
Holly Oak Doris ..	J. A. Mitchell, Longburn ..	2 20	242·5	365	8,018·8	478·92
Beaulieu Lilac's Princess	Dr. G. Walker, Maunu ..	1 334	240·5	365	8,834·7	476·35
Otterburn Victress ..	Estate of A. A. Wagstaff (deceased), Waihou	1 275	240·5	300	7,227·8	459·95
Uruti Angleen ..	W. Oxenham, Uruti ..	2 17	242·2	365	8,720·1	452·68
Jersey Farm Owlet ..	H. R. Benbow, Ormondville	1 361	240·5	365	7,958·0	420·96
Woodstock Morn ..	A. Banks and Son, Kiwitea	2 91	249·6	282	7,127·2	415·85
Dovedale Sungleam†	R. Weinberg, Niho Niho ..	1 353	240·5	365	6,769·2	412·80
Aldan's Neat Maid ..	J. A. Mitchell, Longburn ..	2 44	244·9	355	7,149·3	401·51
Diana of Sunhill ..	C. Phillips, Otorohanga ..	1 325	240·5	365	6,522·3	396·74
Almadale Blonde ..	J. T. Entwisle, Cambridge..	2 10	241·5	333	7,104·0	361·92
Jersey Brae Winsome	T. Church, Te Rapa ..	2 2	240·7	365	6,739·2	361·89
Llangollen Flower ..	J. T. Entwisle, Cambridge..	1 342	240·5	356	6,950·4	356·80
Clarionet's Victress ..	B. N. and W. Sandilands, Feilding	2 19	242·4	285	5,305·5	350·33
Uruti Mavis ..	W. Oxenham, Uruti ..	1 302	240·5	308	7,031·2	350·25
Rosebury Julia ..	J. T. Entwisle, Cambridge..	1 289	240·5	348	6,342·6	341·51
Beaulieu Silver Lily ..	Dr. G. Walker, Maunu ..	2 68	247·3	365	7,279·1	339·54
Wonder Maiden ..	B. N. and W. Sandilands, Feilding	1 362	240·5	314	5,394·3	338·64
Mistress of O.K. ..	E. Jamieson, Paeroa ..	2 26	243·1	364	6,383·5	335·68
Orange Dale Eventide	W. J. Hall and Son, Matatoki	1 275	240·5	333	6,534·5	315·36
Rower's Carnation ..	J. T. Warman, Katikati ..	1 313	240·5	365	5,537·5	293·03
Daffodil of Stonycroft	S. Unwin, Winchester ..	1 360	240·5	365	5,476·3	288·20
Senior Two-year-old.						
Holly Oak Bouquet ..	R. S. Tuck, Waharoa ..	2 350	275·5	365	10,989·0	644·99
Middlewood Baby ..	Kilgour Sisters, Kiwitea ..	2 359	276·4	365	8,482·6	506·50
Takapu Ladylike ..	R. C. Jury, Tikorangi ..	2 108	251·3	344	7,999·3	489·44
Silverstream Elite ..	G. B. Hull, Silverstream ..	2 94	249·9	365	7,584·0	357·68
Three-year-old.						
Snow View Bonnie ..	R. S. Tuck, Waharoa ..	3 312	308·2	365	11,628·0	717·04
Tolgarth Angerline ..	Late W. T. Williams, Pukehou	3 324	309·4	365	10,801·8	686·67

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS—*continued*					
Three-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Kowhai Sunshine ..	J. A. Mitchell, Longburn ..	3 99	286·9	365	10,029·1	582·03
Jersey Meadows Curly	H. H. Phillips, Te Rehunga	3 10	278·0	365	7,999·4	500·13
Rewa Sainton ..	A. Christie and Co., Tanekaha	3 22	279·2	343	8,597·3	494·26
Dominion Godetia ..	Ruakura Farm of Instruction, Hamilton	3 351	312·1	338	9,080·4	476·72
Sybil's Majesty's Pride	Late W. T. Williams, Pukehou	3 54	282·4	364	8,068·4	442·04
Pelynn Bright Star ..	L. K. Tarrant, Ngaere ..	3 312	308·2	344	7,321·0	437·19
Ribbonwood Girlie ..	Cook Hospital Board, Gisborne	3 45	281·5	365	8,410·0	415·03
Silverstream Erica ..	G. B. Hull, Silverstream ..	3 294	306·4	351	7,472·1	384·66
Four-year-old.						
Distinction's Tiny ..	A. E. Phillips, Maunu ..	4 25	316·0	365	10,665·9	639·68
Violet's Gift ..	F. Phillips, Otorohanga ..	4 349	348·4	351	11,075·6	527·97
Mercedes Loo's Majesty	A. Christie and Co., Tanekaha	4 144	327·9	365	8,408·8	461·34
Jenny's Queen ..	R. S. Tuck, Waharoa ..	4 317	345·2	335	6,556·2	365·95
Orange Dale Sylvia ..	C. I. Phillips, Otorohanga ..	4 98	323·3	322	6,494·4	330·86
Mature.						
Otterburn Lilac ..	R. S. Tuck, Waharoa ..	5 119	350·0	365	13,626·6	729·54
Viola's Fair Lady ..	R. Harper, Otorohanga ..	7 5	350·0	365	10,054·8	679·02
Springdale Lady Oculist	J. A. Blake, Waipawa ..	6 40	350·0	365	12,868·0	666·29
Anscerine	Late W. T. Williams, Pukehou	13 72	350·0	364	12,948·3	631·82
Waipiko Rosina ..	J. A. Mitchell, Longburn ..	10 8	350·0	356	11,660·2	585·24
Abberly Naomi ..	Dr. G. Walker, Maunu ..	8 32	350·0	365	11,693·6	544·96
Cowslip's Mischief ..	Late W. T. Williams, Pukehou	5 308	350·0	357	9,752·9	522·22
Takapu Daisy ..	R. C. Jury, Tikorangi ..	6 67	350·0	328	8,517·5	520·87
Rewa Maycan ..	Dr. G. Walker, Maunu ..	9 22	350·0	325	8,664·9	495·71
Bouquets Carnation	J. A. Blake, Waipawa ..	5 146	350·0	337	8,181·7	449·76
Lady Pansy Dudley	Dr. G. Walker, Maunu ..	5 92	350·0	283	5,325·7	374·97
	FRIESIANS.					
Junior Two-year-old.						
Rosevale Burkeyje Sylvia Posch*	North and Sons, Omimi ..	1 223	240·5	365	17,908·6	586·07
Melrose Sylvia Model Keyes*	T. Sheriff, Clandeboye ..	2 47	245·2	365	18,043·3	583·88
Rosevale Sylvia Colantha Posch*	North and Sons, Omimi ..	2 133	253·8	365	17,499·0	569·88
Rosevale Sylvia Beets Posch*	North and Sons, Omimi ..	2 126	253·1	365	15,737·9	543·28
Greenhill Burke Queen 2nd*	J. I. Royds, Christchurch ..	2 87	249·2	365	15,591·5	541·55
Lichfield Madge Ormsby†	W. J. Polson, Fordell ..	2 43	244·8	365	12,212·4	445·43
Livingstone Jessie Beets	W. J. Eames, Hunterville ..	2 29	243·4	340	11,380·6	414·39
Hobson Mona Beauty	V. E. Aitkenhead, Parakai	2 49	245·4	365	9,393·4	327·89
Tamahine Clover ..	W. Bryant, Otokia ..	2 29	243·4	365	6,931·6	301·72
Hobson Westport Pontiac	Hobson Farm Ltd., Wharepapa	1 336	240·5	365	8,863·9	296·53
Hobson Princess Valdessa	Hobson Farm Ltd., Wharepapa	1 328	240·5	285	7,825·0	285·45

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	FRIESIANS—*continued.*					
Senior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Lichfield Glen Lady†	W. J. Polson, Fordell ..	2 337	274·2	365	14,243·9	478·61
Anawhata Pietje Pontiac Minto 13th	P. F. Boucher, Kumeu ..	2 325	273·0	310	9,323·0	345·48
Junior Three-year-old.						
Anawhata Dorothy Minto 12th	P. F. Boucher, Kumeu ..	3 7	277·7	303	9,321·7	351·56
Senior Three-year-old.						
Rosevale Echo Sylvia Colantha*	North and Sons, Omimi ..	3 194	296·4	365	17,881·7	666·38
Merrylea Inka Keyes†	McDonald and Co., Waitati	3 322	309·2	352	12,394·7	417·66
Junior Four-year-old.						
Bainfield Netherland Duchess 2nd*	Fraser and Kirkness, Waikiwi	4 27	316·2	365	16,125·2	634·54
Senior Four-year-old.						
Rosevale Helena Waldorf Posch*	North and Sons, Omimi ..	4 326	346·1	365	18,886·3	656·13
Mature.						
Regina Posch of the South*	H. North and Sons, Omimi	6 263	350·0	365	21,490·7	823·66
Rosevale Isobel* ..	H. North and Sons, Omimi	9 31	350·0	365	24,523·3	773·31
Rosevale Sylvia Beets de Kol*	H. North and Sons, Omimi	5 332	350·0	365	19,479·1	610·54
	MILKING SHORTHORNS.					
Mature.						
Allandale Honor† ..	R. S. Allan, Hatuma ..	8 39	350·0	365	16,802·5	561·43
Allandale Garnett† ..	R. S. Allan, Hatuma ..	6 22	350·0	365	15,374·9	498·58
	GUERNSEYS.					
Three-year-old.						
Dominion Du Preel ..	Ruakura Farm of Instruction, Hamilton	3 332	310·2	365	9,260·3	487·46

Second-class Certificates.

Jerseys.

Junior Two-year-old.						
Beaulieu Soumise Girl	Dr. G. Walker, Maunu ..	1 345	240·5	365	6,968·8	419·54
Silverstream Whin ..	G. B. Hull, Silverstream ..	2 0	240·5	365	6,606·6	353·72
Mature.						
Dominion Ideality ..	Ruakura Farm of Instruction, Hamilton	5 243	350·0	365	10,441·1	551·95

Friesians.

Junior Two-year-old.						
Hanley Netherland Queen*	G. H. Hassall, Clarkville ..	2 80	248·5	365	16,769·9	602·77
Senior Three-year-old.						
Bainfield Sylvia Clover 2nd	W. Bryant, Otokia ..	3 297	306·7	365	11,316·5	406·23

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
Second-class Certificates—continued.						
Ayrshires.						
Mature.		Yrs. dys.	lb.		lb.	lb.
Maesgwyn Maire ..	C. M. Williams, Kaiapoi ..	6 57	350·0	365	16,419·9	638·80
Red Polls.						
Two-year-old.						
Dominion Fairy Gold	Central Development Farm, Weraroa	2 277	268·2	365	6,571·1	305·51

CRAIGALEA BONNIE (J. G. ROBERTSON, ELTHAM).

C.O.R. in Jersey four-year-old class: 12,664·3 lb. milk, 728·58 lb. butterfat. Highest record for the class in 1928.

Arthritis in Lambs.—The Officer in Charge, Wallaceville Veterinary Laboratory, reported recently: "Eight lambs sprayed in the cut scrotum or on the tail-stump with culture from definite cases of arthritis developed severe lameness. None did well during the season and are culls. One developed a typical joint, as found in the freezing-works, and a second has a deformed spine, apparently due to abscess-formation. Field-work is still lacking in connection with this disease, but cleanliness in docking is obviously the solution, together with clean paddocks following docking."

CLASSIFICATION OF CATTLE IN NEW ZEALAND AT 31st JANUARY, 1928.

Land District (including Interior Boroughs).	Bulls Two Years Old and over, for Stud.		Cows and Heifers Two Years Old and over, for Dairying.		Other Cows and Heifers Two Years Old and over.	Heifers One and under Two Years Old.	Steers Two Years Old and over.	Steers and Bulls One and under Two Years Old.	Calves under One Year Old.		Total Cattle.
	For Beef Purposes.	For Dairy Purposes.	In Milk.	Dry.					Heifer.	Steer.	
North Auckland ..	795	7,381	202,392	18,923	37,281	56,443	46,538	16,894	61,608	16,803	465,058
Auckland	1,266	12,637	350,770	23,743	53,499	89,016	66,391	19,722	99,953	16,871	733,868
Gisborne	2,863	1,205	29,935	5,065	102,877	28,106	46,326	19,120	34,277	25,627	295,401
Hawke's Bay	1,418	1,706	45,512	5,904	49,500	18,644	35,186	9,872	21,996	13,041	202,779
Taranaki	468	7,489	196,955	10,224	21,850	38,727	19,141	7,036	48,471	6,441	356,802
Wellington	3,579	6,802	180,046	18,145	128,423	61,171	97,809	28,162	67,967	34,100	626,204
Nelson	127	1,227	25,337	3,479	6,762	7,173	5,889	2,857	7,546	3,089	63,486
Marlborough	155	680	14,320	2,031	5,293	4,896	4,153	2,370	4,910	2,238	41,046
Westland	182	501	10,929	1,531	7,489	4,123	5,855	2,463	4,545	2,588	40,206
Canterbury	370	2,889	69,991	7,968	14,512	19,275	16,791	7,300	19,369	7,280	165,745
Otago	243	2,096	49,299	6,599	10,396	14,898	13,210	6,394	15,163	7,125	125,423
Southland	244	3,011	67,243	6,057	13,307	20,152	12,264	6,728	19,866	8,879	157,751
Totals, Dominion, 1928	11,710	47,624	1,242,729	109,669	451,189	362,624	369,553	128,918	405,671	144,082	3,273,769
Totals, Dominion, 1927	11,972	46,870	1,181,545	121,680	482,973	384,743	384,525	158,459	357,658	127,304	3,257,729

—Census and Statistics Office.

WEATHER RECORDS: MARCH, 1929.

Dominion Meteorological Office.

GENERAL NOTES.

THE month of March was a very wet one over much the greater part of the Dominion. In many districts the average fall was greatly exceeded. Slight deficits were experienced at scattered places in the central parts of the North Island from Taranaki to Hawke's Bay, and from the Bay of Plenty to the Wairarapa. A few places in Canterbury, South Westland, and Southland also had less than the normal.

The rain, following on a dry February, was very beneficial. Pastures are in a good condition and prospects for winter feed favourable over almost the whole country. Stock and crops also were in good condition at the end of the month. Temperatures were slightly below normal, especially in districts with an easterly aspect, where also there was considerable cloudiness. In a few cases the damp and dull weather has interfered with harvesting operations.

Among the outstanding features of the month was a cyclone of very small dimensions, which, after having been met by the s.s. "Tofua" on her way from Fiji to Auckland, crossed from the Bay of Plenty to Poverty Bay between the 17th and 18th. Gales of great severity, though fortunately of short duration, were experienced, and some damage was done in the environs of Opotiki and Gisborne. Another feature was the torrential downpour which occurred during a southerly gale over the eastern portions of Otago on the evening of the 19th. Around Dunedin the falls varied between about 4 in. and 11 in., the heaviest occurring in the watershed of the Leith Stream. The Leith rose rapidly to record flood-level, and, in addition to doing very serious damage along its own banks, caused heavy flooding of the northern business portion of Dunedin. Oamaru also recorded over 6 in. of rain, and experienced heavy flooding accompanied by some damage to property.

Still another unusual phenomenon was the occurrence of aurora australis on four nights during the month—the 10th, 12th, 13th, and 17th. The display of the 12th was particularly brilliant. Large spot groups were noted on the central portion of the sun on or about these days.

On the 1st an intense cyclonic storm had developed east of Brisbane. This storm remained in the northern Tasman Sea until the 4th, after which it disappeared without affecting New Zealand to any very great extent. On the 5th, however, a deep southern depression advanced from the Tasman Sea, and had not completely crossed the Dominion until the 8th, when strong southerly winds set in. General rain fell, culminating on the 6th in very heavy falls over most of the North Island and the Nelson and Westland provinces. Some flooding was caused on the west coast, especially at Greymouth.

On the 17th another deep depression developed in the south Tasman Sea, and became cyclonic before reaching New Zealand. The centre crossed northern Otago on the evening of the 19th, and the floods mentioned above were associated with it. Southerly gales followed in its wake. In addition to the specially heavy falls described, rain was general in other districts. Snow fell on the ranges of the South Island. The weather was cold between the 20th and the 22nd, and frosts occurred at southern inland stations.

The storm of the 19th was followed by an intense anticyclone, which did not move finally away eastward until the 25th. On this date another intense depression developed in the south Tasman Sea, and caused unsettled weather until the end of the month. There were northerly gales on the 26th and 27th, especially about Cook Strait. Rain was again general, with many heavy falls. The change to southerlies came on the 30th, when snow fell on the high country of the South Island and low temperatures were experienced. The 31st was still more severe, and frosts were recorded at many places. The southerlies were of gale force at many places on the 30th and 31st.

There was again a relative absence of westerly winds and a prevalence of southerlies during the month.

—Edward Kidson, Director of Meteorological Services, Wellington, 5th April, 1929.

RAINFALL FOR MARCH, 1929, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Rainfall.
	North Island.	Inches.		Inches.	Inches.
1	Kaitaia	4·09	10	1·10	3·58
2	Russell	2·74	13	1·15	3·13
3	Whangarei	6·04	15	1·85	4·52
4	Auckland	5·62	16	2·33	3·03
5	Hamilton	5·50	12	1·77	3·88
6	Kawhia	6·62	15	2·08	3·43
7	New Plymouth	4·69	15	0·90	3·62
8	Riversdale, Inglewood ..	6·57	15	2·04	7·39
9	Whangamomona	6·10	12	1·50	5·61
10	Eltham	2·53	12	0·62	4·68
11	Tairua	4·28	11	1·44	5·92
12	Tauranga	4·68	12	1·84	4·16
13	Maraehako Station, Opotiki	4·16	12	1·66	4·09
14	Gisborne	3·38	13	0·99	4·51
15	Taupo	4·80	13	1·58	3·25
16	Napier	3·81	16	2·35	3·29
17	Maraekakaho Stn., Hastings	2·74	11	0·68	3·10
18	Taihape	2·42	15	0·44	2·95
19	Masterton	1·86	13	0·91	3·15
20	Patea	3·77	13	1·00	3·62
21	Wanganui	2·17	10	0·60	2·62
22	Foxton	2·80	9	0·66	2·20
23	Wellington (Karori Reservoir)	4·79	17	2·08	3·48
	South Island.				
24	Westport	9·57	17	2·39	5·80
25	Greymouth	13·04	17	3·50	8·70
26	Hokitika	11·90	18	2·81	9·70
27	Ross	13·49	13	3·58	10·35
28	Arthur's Pass	15·82	11	5·57	9·74
29	Okuru, Westland	14·78	14	2·72	15·48
30	Collingwood	11·63	11	3·12	4·19
31	Nelson	5·44	10	1·31	3·08
32	Spring Creek, Blenheim ..	4·15	12	1·85	2·16
33	Tophouse	7·18	12	1·45	4·33
34	Hanmer Springs	3·74	14	0·48	2·89
35	Highfield, Waiau	2·68	10	0·50	3 00
36	Gore Bay	2·21	12	0·43	2·29
37	Christchurch	3·49	11	1·13	2·05
38	Timaru	3·62	10	2·22	2·31
39	Lambrook Station, Fairlie ..	2·42	8	1·22	2·47
40	Benmore Station, Clearburn	4·14	8	2·56	2·69
41	Oamaru	7·47	11	6·16	1·73
42	Queenstown	3·99	10	0·85	2·60
43	Clyde	1·86	6	0·83	1·50
44	Dunedin	7·47	14	5·29	2·98
45	Wendon	4·03	10	2·09	2·68
46	Gore	3·08	15	1·15	3·27
47	Invercargill	4·36	21	0·70	3·90
48	Puysegur Point	9·34	18	2·12	8·00
49	Half-moon Bay, Stewart Is.	5·12	16	1·28	5·79

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

STOMATITIS IN LAMBS.—MATING OF EWES.

G. W., Waipapa, Bay of Islands :—

(1) A number of my lambs in December became affected with sore mouths and sores at the base of the nose. The lambs were still on the ewes. The trouble lasted for about three weeks, after which time all the lambs recovered. Could you suggest the cause of the trouble and a safeguard against further infection. The sheep are on top-dressed flat land. (2) What time should elapse before the rams are put with newly dipped ewes? (3) What number of young rams should be run per 100 ewes in small paddocks on clear ground?

The Live-stock Division :—

(1) This trouble is known as stomatitis, and may be transferred to the udder of the ewe from the affected lamb's mouth. Although the disease is contagious in nature, it is not considered a very serious complaint, and lends itself to treatment. It is advisable to give the sheep a change of pasture, and, if desired, isolate the affected lambs along with their mothers. A simple ointment will cure the disease—one part of flowers of surphur and eight parts of vaseline or lard. Smear the ointment on the lamb's mouth, and in turn the lamb will apply it to the udder of the ewe. Stomatitis cannot really be safeguarded against unless the sheep and lambs are put on the shortest pasture available. (2) The rams may be put to the ewes as soon as the latter have dried, but it is a much better practice to have the ewes dipped at least one week before turning the rams out. (3) It is usual to allow two rams for 100 ewes, but they should not be all turned among the ewes at one time. It is better to have fresh rams to turn out after the lapse of a week or ten days.

HEIFER WITH WATERY EYE.

S. G. MOORE, Ruawai :—

I have a four-months-old heifer which has had a watery eye since birth. It is now discharging a little. Could you tell me if there is any cure?

The Live-stock Division :—

The cause of the trouble is probably partial occlusion of the duct which carries away the tears, or some other deformity which you can do little for. As the eye is now discharging you might treat as follows: Dissolve a dessertspoonful of boracic powder in half a medium-sized bowl of boiling water, and add a little cold water to cool it down. Wash the eye out every day. Procure a small tube of eye-ointment containing yellow oxide of mercury from a chemist, place a small portion under the eyelid, and allow it to work in itself. Do this daily after bathing. This treatment will perhaps prevent a growth forming, which very often happens where there is any irritation to the mucous membranes of the eye.

MILDEW AND RUST ON HAMS AND BACON.

M. F., Woodville :—

Could you give me a reliable recipe or method for preventing mildew and rust from forming on hams and bacon while being stored for a considerable period? My practice is to cure the bacon, then smoke it, and then roll it very tightly. The hams and shoulders are all boned before curing, so when they are rolled it reduces the mildew and rust to a minimum; but even so, with long keeping, parts are apt to become tainted with rust.

The Live-stock Division :—

One of the first things to be done after the hams and bacon are taken out of the salt or pickle is to see that the parts are properly dried by hanging out in the open in the sun and wind before smoking. It is a good practice to then dust all the portions with pea-flour. This will absorb all remaining moisture which may be in the crevices or joints. Then smoke and roll. Owing to the temperature of most places on the farm not being under control, it is wise to bag the hams and bacon for further protection. In some cases even this is not a sufficient safeguard, so a systematic examination is necessary periodically. Take off the bags and wipe the bacon and hams. Always choose a dry place with ventilation for hanging.

SALE OF CERTIFIED SEED-WHEAT.

WITH a view to stimulating the distribution of pure seed-wheat the Department of Agriculture, in co-operation with the Wheat Research Institute, organized in the 1927–28 season a system of seed-wheat certification, which was fully described in the *Journal* for April, 1928.

Briefly, certified seed-wheat is the produce of areas inspected in the field by an officer of the Department, machine-dressed, and passed by the official Grader. The price of certified seed-wheat is based on the current price of milling-wheat on 31st March, to which is added a bonus to growers, dressing and handling charges, and merchant's commission. Thus all certified seed-wheat is sold at a uniform price in any one centre.

The following firms are handling Solid-straw Tuscan and Hunter's certified seed-wheat at the places specified, and growers should apply direct to them for their requirements :—

Blenheim.

W. E. Clouston and Co.

Rangiora.

N.Z. Farmers' Co-operative Association.

Christchurch.

Dalgety and Co.
Pyne, Gould, Guinness.
H. Matson and Co.
N.Z. Loan and Mercantile Agency Co.
Wright, Stephenson, and Co.
Wood Bros.
N.Z. Farmers' Co-operative Association.
Canterbury Seed Co.

Leeston.

Canterbury Seed Co.

Ashburton.

National Mortgage and Agency Co.
Wright, Stephenson, and Co.
Pyne, Gould, Guinness.
N.Z. Farmers' Co-operative Association.

Timaru.

Canterbury Farmers' Co-operative Association.
Wright, Stephenson, and Co.
J. Meehan and Sons.
Dalgety and Co.
N.Z. Loan and Mercantile Agency Co.
D. C. Turnbull and Co.
A. B. Annand and Co.
Pyne, Gould, Guinness.

Waimate.

Pyne, Gould, Guinness.

Oamaru.

Ireland and Co.
Darling and McDowell.
N.Z. Loan and Mercantile Agency Co.
Wright, Stephenson, and Co.
North Otago Farmers' Co-operative Association.

Dunedin.

Waters, Ritchie, and Co.
Dalgety and Co.
N.Z. Loan and Mercantile Agency Co.

Mineral Hunger in Sheep.—The successful experiment in feeding mineral food to sheep by the pellet method, as recorded in the *Journal* for January last, has since been repeated on some sheep showing symptoms of bush sickness at the Mamaku Demonstration Farm, and with the same good results.

WHEAT AND OATS THRESHINGS, 1929 HARVEST.

TABULATED below are returns of threshings of this season's wheat and oat crops received by the Census and Statistics Office up to 19th March. It will be observed that at that date very little had been threshed in Southland, where the season is appreciably later than in North Otago and Canterbury.

Land District.	Wheat.					
	Firsts.			Seconds.	Total Threshed.	Average Yield per Acre.
	Tuscan or Longberry.	Hunter's (Varieties).	Pearl or Velvet.			
	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
Gisborne	452	116	..	24	592	16·44
Hawke's Bay ..	3,878	..	108	351	4,337	24·23
Wellington ..	27,681	5,934	26	1,956	35,597	34·63
Nelson	7,102	3,664	1,909	785	13,460	26·34
Marlborough ..	49,459	16,129	2,768	4,757	73,113	30·05
Canterbury ..	2,018,046	360,825	165,698	121,058	2,665,627	36·91
Otago	102,477	74,163	35,725	17,251	229,616	31·94
Southland ..	1,321	..	..	..	1,329	22·78
Totals ..	2,210,416	460,831	206,234	146,182	3,023,663	36·14

Land District.	Oats.					
	White.	Dun.	Black.	Algerian.	Total Threshed.	Average Yield per Acre.
	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
Hawke's Bay ..	..	..	..	2,784	2,784	32·75
Wellington ..	2,021	264	..	14,833	17,118	44·81
Nelson	180	..	..	1,972	2,152	30·31
Marlborough ..	634	156	220	14,199	15,209	33·80
Canterbury ..	358,634	43,684	3,460	139,082	544,860	40·81
Otago	57,859	6,738	2,090	13,719	80,406	38·99
Southland ..	672	..	..	..	672	33·60
Totals ..	420,000	50,842	5,770	186,589	663,201	40·38

FORTHCOMING WINTER SHOWS.

ADVICES of the following shows have been received :—

Southland A. and P. Association : Invercargill, 11th to 18th May.
Whangarei A. and P. Society : Whangarei, 14th to 18th May.
Bay of Plenty Winter Show : Whakatane, 22nd to 25th May.
Waikato Winter Show Association : Hamilton, 28th May to 3rd June.
Otago A. and P. Society : Dunedin, 1st to 7th June.
Taumarunui and District Winter Show Association : 6th to 8th June.
Poverty Bay Winter Show Association : Gisborne, 12th to 15th June.
Manawatu A. and P. Association : Palmerston North, 18th to 22nd June.
South Taranaki Winter Show Company : Hawera, 28th June to 3rd July.
Auckland A. and P. Association : Auckland, 3rd to 13th July (provisional).
Wanganui A. and P. Association : Wanganui, 4th to 6th July.
Wellington Winter Show Association, 9th to 26th July.
Stratford A. and P. Association : Stratford, 10th to 13th July.